FLYING

SEPTEMBER, 1944

VOLUME 35 • NUMBER 3

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To Men Who Are Looking Ahead to a FUTURE CAREER

You know that any successful career is built on a solid foundation by thorough training.... You know that present day opportunities are great in any phase of activity, but above all you know that Aviation presents the greatest opportunities.... You know it is the youngest, fastest growing and the largest industry in today's field of activity, which is but a preview of its future.

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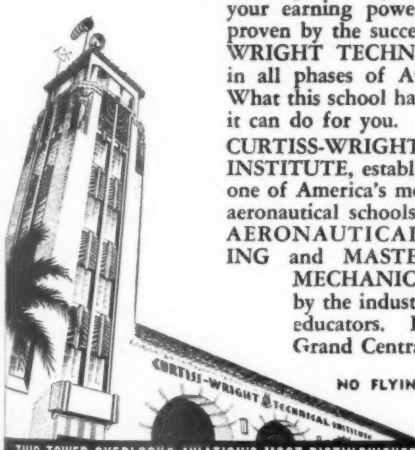

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Trail Blazing in the Skies

HOW GOODYEAR AIRCRAFT CORPORATION SERVES THE AIRCRAFT INDUSTRY

1. *By constructing subassemblies to manufacturers' specifications.*
2. *By designing parts for all types of airplanes.*
3. *By re-engineering parts for quantity production.*
4. *By building complete airplanes and airships.*
5. *By extending the facilities of Goodyear Research to aid the solution of any design or engineering problem.*

★

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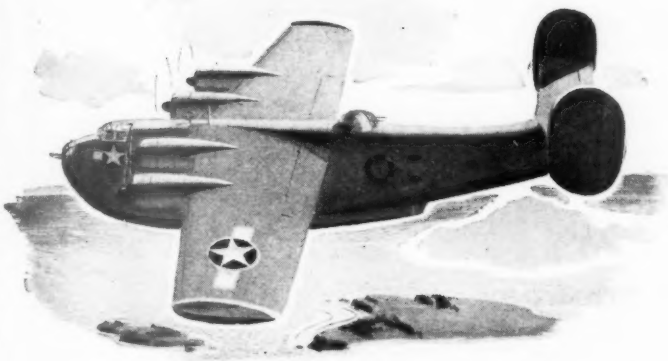
PIONEERING NEW METHODS

CLOSE TOLERANCE ON AIRCRAFT PARTS naturally results in cheaper, easier, faster assembly, particularly where much unskilled labor must be employed. To effect this tolerance control from design to finished product, Goodyear Aircraft Corporation in 1941 set up the Dimensional Control Department of the Engineering Technical Service Division. Functions of this Department have been the control of dimensional accuracy of engineering information; the specification of tolerances, points of interchangeability and of coordination; the accuracy of assembly fixtures, etc. Results have been impressive savings of time and money — another Goodyear contribution to aircraft mass production.

BUILDING PROVEN AIRCRAFT



OUTER WINGS FOR THE PB2Y CORONADO are among the many important jobs, from bomber and fighter components to complete Navy Corsairs, speeding successfully along Goodyear Aircraft's production lines. Veteran experience in the field of light metal construction plus thirty years of pioneering in aeronautical design and production have made such assignments possible. It enables Goodyear to deliver quickly, expertly and to the satisfaction of the armed services and the prime contractor. Valid testimony to Goodyear operation and construction methods.

GOODYEAR
AIRCRAFT

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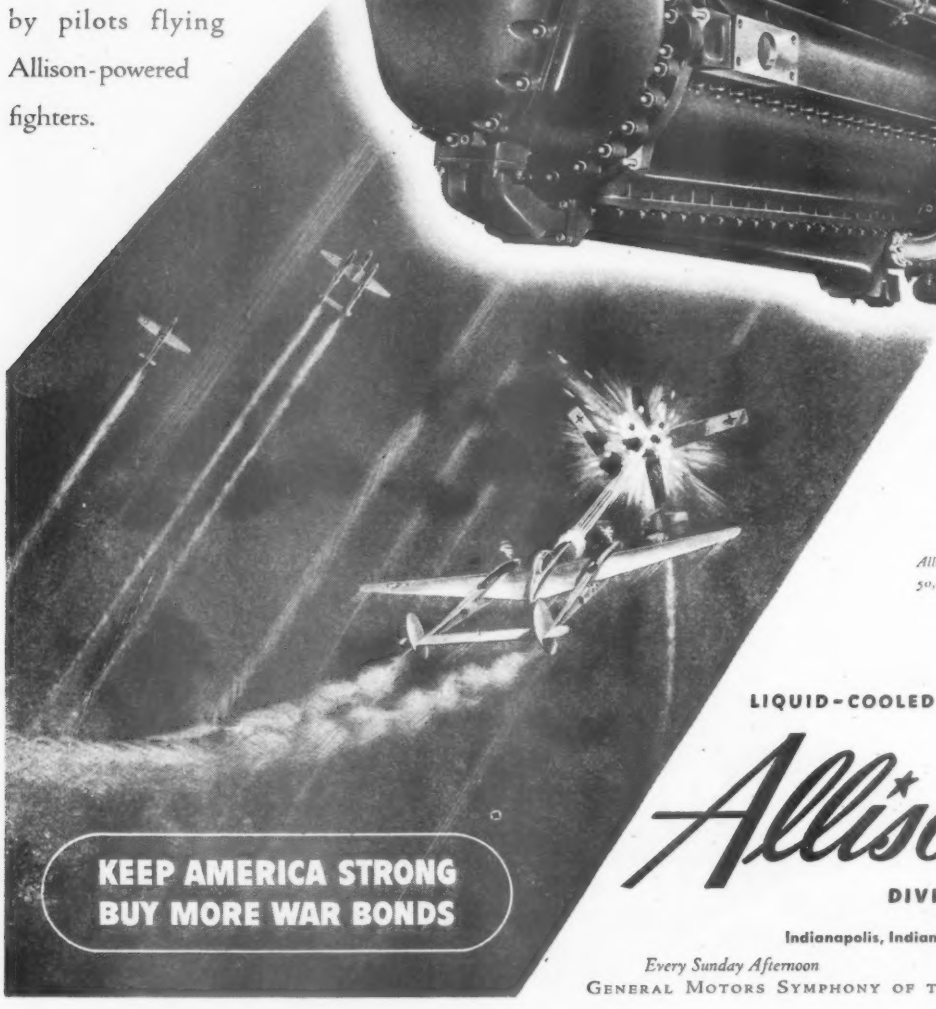
U. S. Army pilots have flown more Allison-powered fighter planes into battle than planes powered by any other engine. ★ Pilots like Allison *reliability* to get there and back — *durability* to stand up under more fighting hours — *economy* to extend range — *smoothness* to reduce pilot fatigue. ★ This numerical superiority and these Allison qualities have added much to America's fighting edge. Thousands of enemy planes have been downed by pilots flying Allison-powered fighters.



KEEP AMERICA STRONG
BUY MORE WAR BONDS

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P-38—Lightning
P-39—Airacobra
P-40—Warhawk
A-36 and P-51—Mustang
P-63—Kingcobra

Allison has already furnished more than 50,000 engines for use in these planes.

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Allison

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THE NEW KOLLSMAN MACHMETER is an instrument which gives a pilot advance warning when his plane approaches the speed of sound—a speed at which an entirely new set of aerodynamic conditions—and dangerous ones—is introduced into the operation of a plane. Since the occurrence of this critical speed varies with altitude and the particular type of plane being operated, an indication of its approach is important for the testing of aircraft. The new Kollsman Machmeter is typical of the special flight test instruments which have been developed by Kollsman for America's Aircraft manufacturers.

KOLLSMAN AIRCRAFT INSTRUMENTS

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TAXIING TO THE "TANG" BY KINGFISHER

THEY were shooting it out over Truk on April 29th and 30th. As hundreds of our planes swarmed over the Jap island fortress in a devastating strike, the Nips were tossing up every ounce of anti-aircraft fire they could muster. The tropic skies were torn by tracer bullets and flak. Some of our aircraft were caught in the deadly fire. Yet from the fallen planes not a single man was lost!

22 of our aviators were rescued by the U.S. Submarine *Tang*. She was called in from her position on patrol to skirt the dangerous shoals and reefs, often under gunfire. Once she paused to give chase to an enemy sub. But hour after hour she cruised back and forth along the entire southern range of the island group to rescue our airmen who had been shot out of the skies. Her largest single rescue was performed with the aid of a battleship's catapult seaplane which had gathered up a company of seven airmen who would otherwise have drifted out to sea, or would have fallen into the hands of the Japs.

Lieut. Comdr. Richard Hetherington O'Kane, commanding the U.S. Submarine *Tang*, was called to retriever duty again in the direction of Ollan Island. American fighter planes, circling overhead, directed him to the liferafts as they spotted them.

Then Commander O'Kane picked up a radio message from Lt. (j.g.) John A. Burns of Wynnwood, Pa., piloting his observation float plane 15 miles distant from the sub, where he had sighted some liferafts holding our airmen.

Lt. Burns, with his crewman Radioman Aubrey James Gill, started to taxi back and forth in his Kingfisher which, as Navy men know, is Edo Float-equipped. On some of his trips to the sub, Lt. Burns had fighter cover . . . more often, none at all.

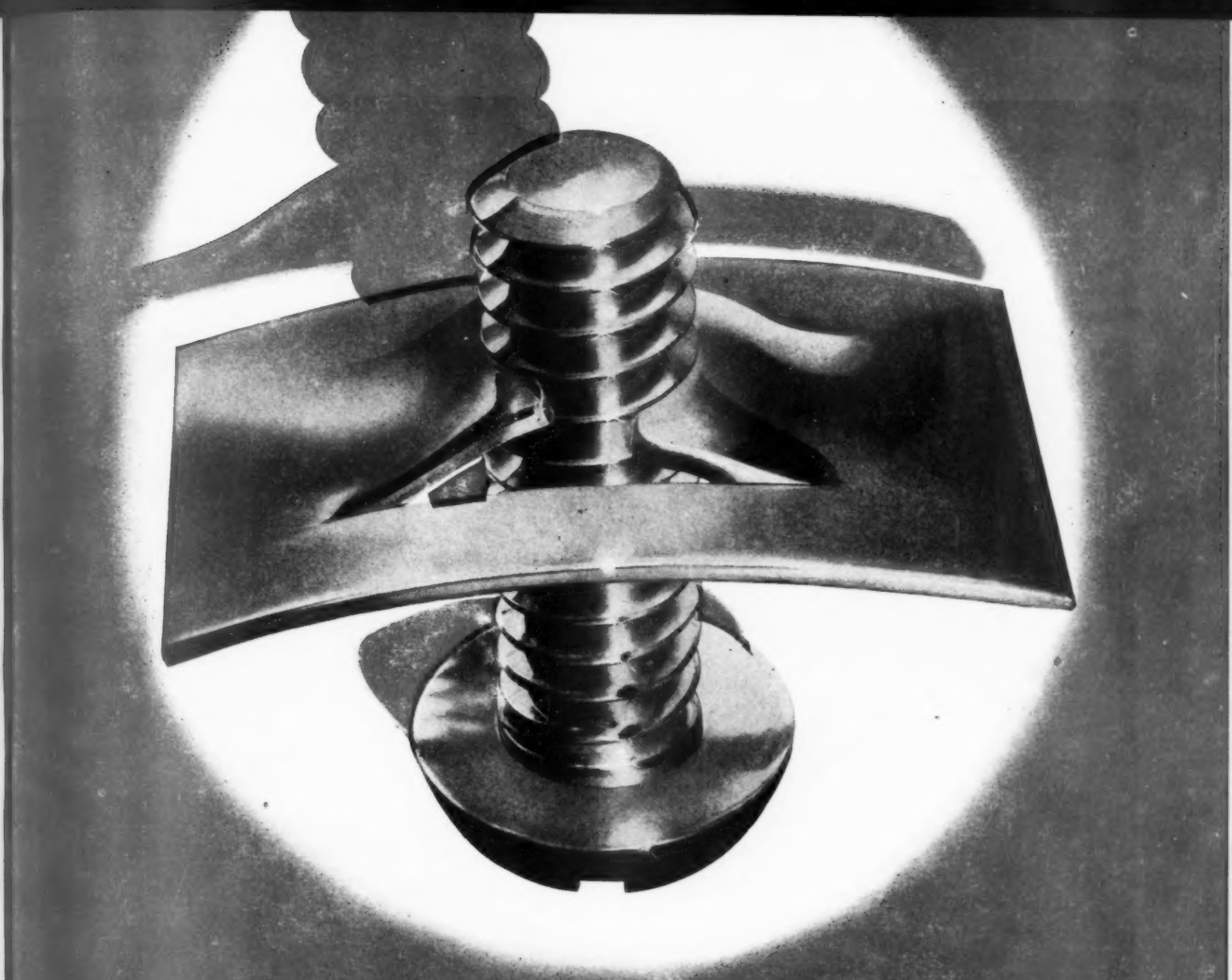
Along about noon, three rafts bearing seven men were sighted on the ocean off the eastern reef of Truk Atoll. The tide wind was carrying them toward the beach—and capture. Burns was down there with them. He must have known he couldn't get off the water and he deserved great credit. With American nerve and resourcefulness, Burns loaded 3 men on each wing and perched the seventh on the edge of the cockpit . . . gunned up his motor and literally taxied on the rough surface of the sea back to the submarine.

They struck a terrific cross wind. The little Kingfisher was badly battered. But Lt. Burns radioed the sub he had plenty of gasoline and "we are all right."

It was 5:30 p.m. before Lt. Burns had taxied his seven passengers to the sub. It had taken six courageous hours to make the trip.

Now a Kingfisher plane is so small it's the butt of many jokes in the Navy . . ."It can carry but three men . . . and then only in a pinch." But you can bet there are seven American fliers—the crews of 2 torpedo planes, 1 dive bomber and 2 fighters—that have nothing but praise for the tiny craft that saved their lives by bouncing back to the *Tang* on her Edo Floats. Edo Aircraft Corporation, 414 2nd St., College Point, N.Y.

EDO FLOAT GEAR
SERVES THE UNITED NATIONS



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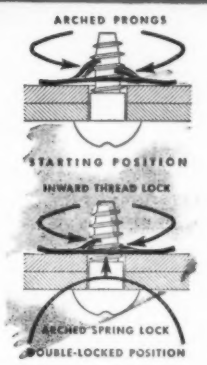
Why? Because It's a *SPEED NUT*

SPEED NUTS are made of heat-treated, live spring steel. They have a live arched spring lock and an inward thread lock. Live spring action absorbs vibration instead of merely resisting it.

Before Pearl Harbor, over two million a day were used on automobiles, refrigerators, stoves, heaters, radios and hundreds of other products. When the shooting is over, still more will be used because more engineers have learned that SPEED NUTS are lighter, double-locking and faster to apply. And in addition to all their exclusive advantages, SPEED NUTS still cost substantially less than other self-locking nuts. Write today.

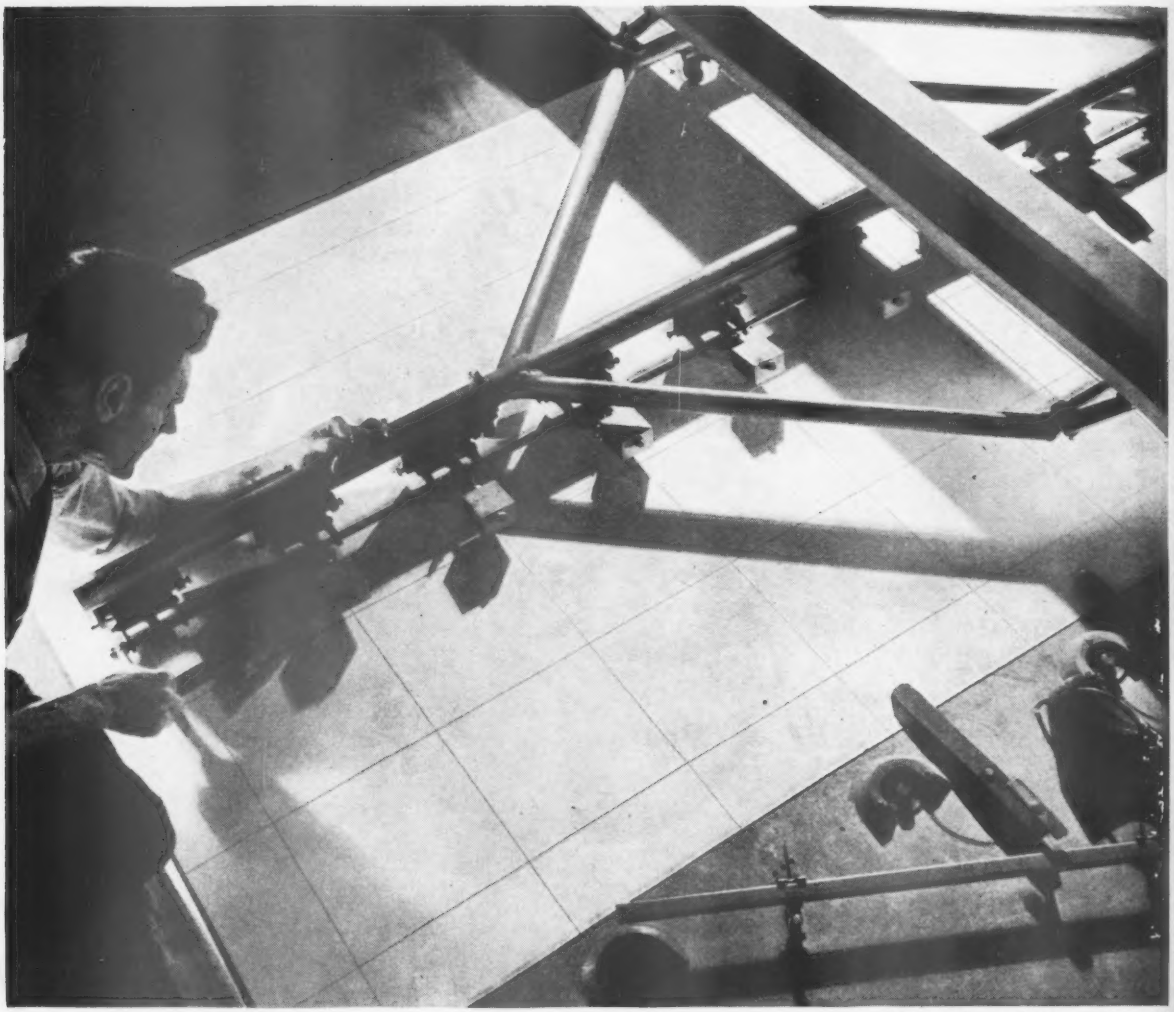


TINNERMAN PRODUCTS, INC.
2086 Fulton Road, Cleveland, Ohio
In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In England: Simmonds Aerocessories, Ltd., London

Speed Nuts* [PATENTED]

*Trademark Reg. U. S. Patent Office

FASTEST THING IN FASTENINGS



Buy War Bonds — to Have and to Hold

Bee-lines to Berlin

A straight line—really *straight*—is one of the hardest things in the world to draw. Yet thousands of mathematically straight lines are necessary to the building of a big airplane like the Boeing Flying Fortress and the B-29 Superfortress.

The master layout drawings for every part of a bomber must be made on flat sheets of lacquered steel. To insure the accuracy of the finished drawing, the metal is first scribed with intersecting reference lines like those on a gigantic sheet of graph paper. And the lines must cross each other in perfect 10-inch squares, without deviating as much as 1/100th of an inch.

Until recently this was a slow and laborious job. Draftsmen sprawled across the big tables hour after hour, ruling in reference lines with straight-edges. But the slightest miscalculation — even the expansion of metal caused by the sun's heat — might ruin their efforts. Drawing the grid lines on master layouts for the frames and bulkheads of one model alone consumed 5600 hours.

Boeing engineers determined to change the method. They built the "Grid Machine" shown above—a simple, supremely accurate device that draws a dozen parallel straight lines while you watch. It never makes a mistake. And it has already saved thousands of priceless hours between blueprint and bombing mission. Today the work is done in *less than a tenth* of the former time.

All through the Boeing plants are similar examples of ingenuity and skill applied to the task of building *more* airplanes *faster* and *more economically* — speeding the production that shortens the distance to Victory.

When the war is won, Boeing's abilities in design, engineering and manufacturing will again be applied to peacetime products. You can be sure of any such product . . . if it's "Built by Boeing" it's bound to be good.

DESIGNERS OF THE FLYING FORTRESS • THE NEW B-29 SUPERFORTRESS • THE STRATOLINER • TRANSOCEAN CLIPPERS **BOEING**

SALT SPRAY TEST
with a vengeance!

Test samples of aviation radio components must be subjected to a standard salt spray test before they may be installed in Naval aviation equipment. This test is designed to prove the durability of the equipment for seaplane operating conditions. That it does was recently demonstrated in dramatic fashion by the transmitter tuning unit pictured at the right.

As the result of an accident, this unit was submerged for nearly two weeks at the bottom of "Censored" Bay. Yet, when it was recovered and installed in another transmitter, it was *still on frequency and delivered normal power*. The value of custom-built RCA aviation radio equipment...with its stainless steel construction, silver-plating of RF conductors, use of ceramics and hermetic sealing of components ...was amply demonstrated by this incident.

Fourteen years of continuous aviation radio experience have resulted in an accumulation of experience and standards which are of great value in judging the proper application of specialized metals, platings, plastics and processes. Throughout the war, RCA continues to apply—and add to—this experience. Postwar, this experience will be equally useful in the manufacture of fine commercial aviation radio equipment. ★

RCA

BUY MORE WAR BONDS

RADIO CORPORATION OF AMERICA

RCA Victor Division • Camden, N. J.

. . . AND THE GLIDERS LED THE WAY

They said it would come on a night when the tide was right—and that's the way it was.

Some guessed that it would be Denmark, while others predicted it would be the Low Countries or straight across the Channel. But those who guessed that it would be Normandy were right because that's the way it was.

They claimed that the planes would be like swarms of locusts in the sky and the ships so numerous that a man would be able to walk from shore to shore without once getting his feet wet—and that's the way it was.

And leading the way, they said, would be the paratroopers and the *glider-borne infantrymen, disrupting communications deep within the enemy's lines hours before the first assault wave hit the beaches. That's how they said it would be—and that's the way it was.

**You have read how the airborne infantry, thousands of them transported in giant gliders, struck the first invasion blow. These gliders were designed by* WACO *and were manufactured by* WACO, *or by the eleven other companies building gliders with the aid of* WACO *blueprints and engineering supervision. After the war, you can rely on* WACO—*one of the oldest names in commercial aviation—to continue the* WACO *tradition of better planes for better flying.* THE WACO AIRCRAFT COMPANY, *Troy, Ohio, U. S. A.*

WACO AIRPLANES

Waco

ALL ARMY CARGO-TRANSPORT GLIDERS ARE WACO DESIGNED

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CABLE TERMINALS
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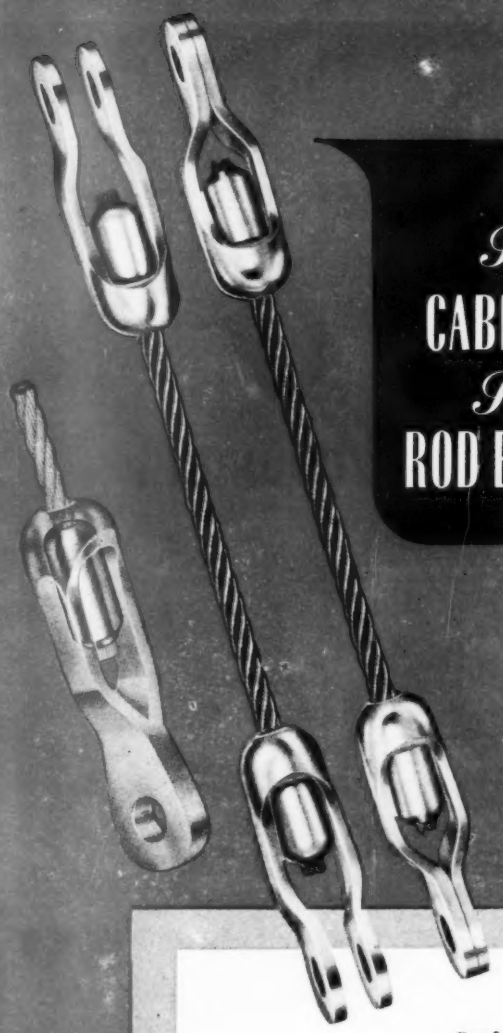
ROD END TERMINALS



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Other Sizes Made to Order

Exclusive Features

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- ★ Saves 90% on Critical Material
- ★ No Engineering Change Necessary

Approved as interchangeable with B and C types of present standard AN 667 and 668.

- ★ High Strength
- ★ Prompt Deliveries
- ★ Interchangeability
- ★ Reduced Service Stocks
- ★ No Tightening Distortion
- ★ Made of Non-Critical Material

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7 sizes in both fork and eye types.

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1/4-28 • 8-32
12-28 • 5/16-24
3/8-24

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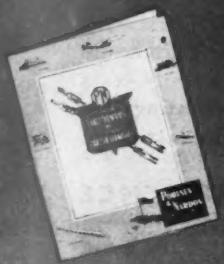
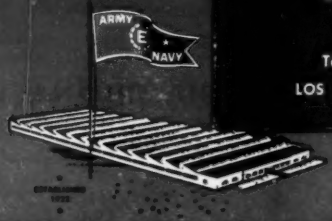


New Specification Sheet and Folder Available to Industry Personnel.



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C26 — Unshielded

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Today, the immense military transport planes are Aerol equipped. This use forecasts the vital contribution Aerols will also make to the safety and efficiency of after-the-war aviation.
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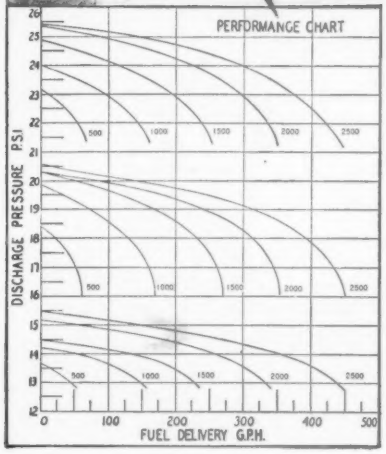
POWER DRIVEN

FUEL PUMP



Here is a fuel pump that will be in big demand for postwar planes. With its higher pressure range of from 6 to 35 lbs., its 400 gallon per hour capacity at 2500 rpm., and its low weight of only 2¾ lbs.—it's sure to be a winner.

Built with a balanced type relief valve with shaft seals that are dependable through extreme temperature ranges. This pump is now in production.

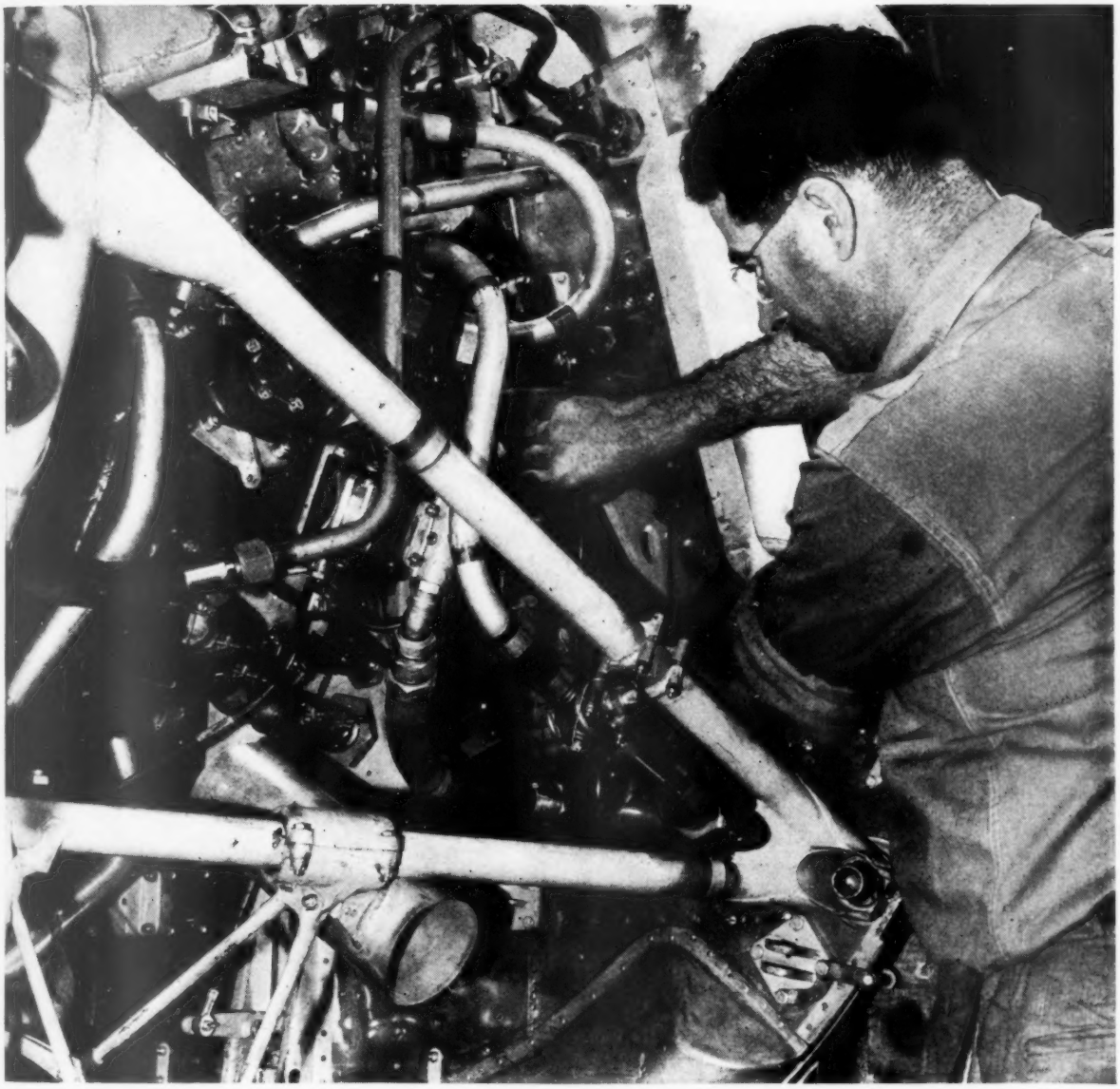
In writing, kindly refer to type G-9.

ROMEC PUMP COMPANY

ELYRIA, OHIO, U. S. A.

Romec

NON-PULSATING PUMPS... ACCESSORIES



New hydraulic hose simplifies front-line repair

REPLACING damaged hydraulic hose sections used to be a complicated, time-consuming process. Attaching stock hose to couplings required a giant press . . . and not many front-line bases had one. The only alternative was to keep thousands of different hydraulic assemblies on hand at all times.

To improve this difficult supply situation, manufacturers developed special couplings which could be attached quickly and easily to the various sizes of stock hose then available. But they weren't successful, because the rubber in the hose would stretch and flow when squeezed between the parts of the coupling. Then pressure would pull the coupling loose.

To make these couplings successful, B. F. Goodrich engineers developed a hose with no layers of rubber outside or between the cord plies. Instead, protecting rubber was forced down into the fibers of the cord as it was braided around the inner tube. There was no free rubber to flow. The jaws of the couplings bit into hard rubberized cords only, and held!

Now Army-Navy standard for medium pressure control lines, this new B. F. Goodrich hose is 30 to 50% lighter and from 20 to 50% stronger than the old type. It is the *only* hydraulic hose that is size-controlled within such close dimensions that reattachable couplings can be used.

Front-line hydraulic hose maintenance is now simpler and quicker. For instead of having to stock thousands of different complete assemblies, a few sets of couplings and a few reels of hose are all a base needs. Assemblies are made up on the spot. The B. F. Goodrich Co., Aeronautical Division, Akron, O.

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

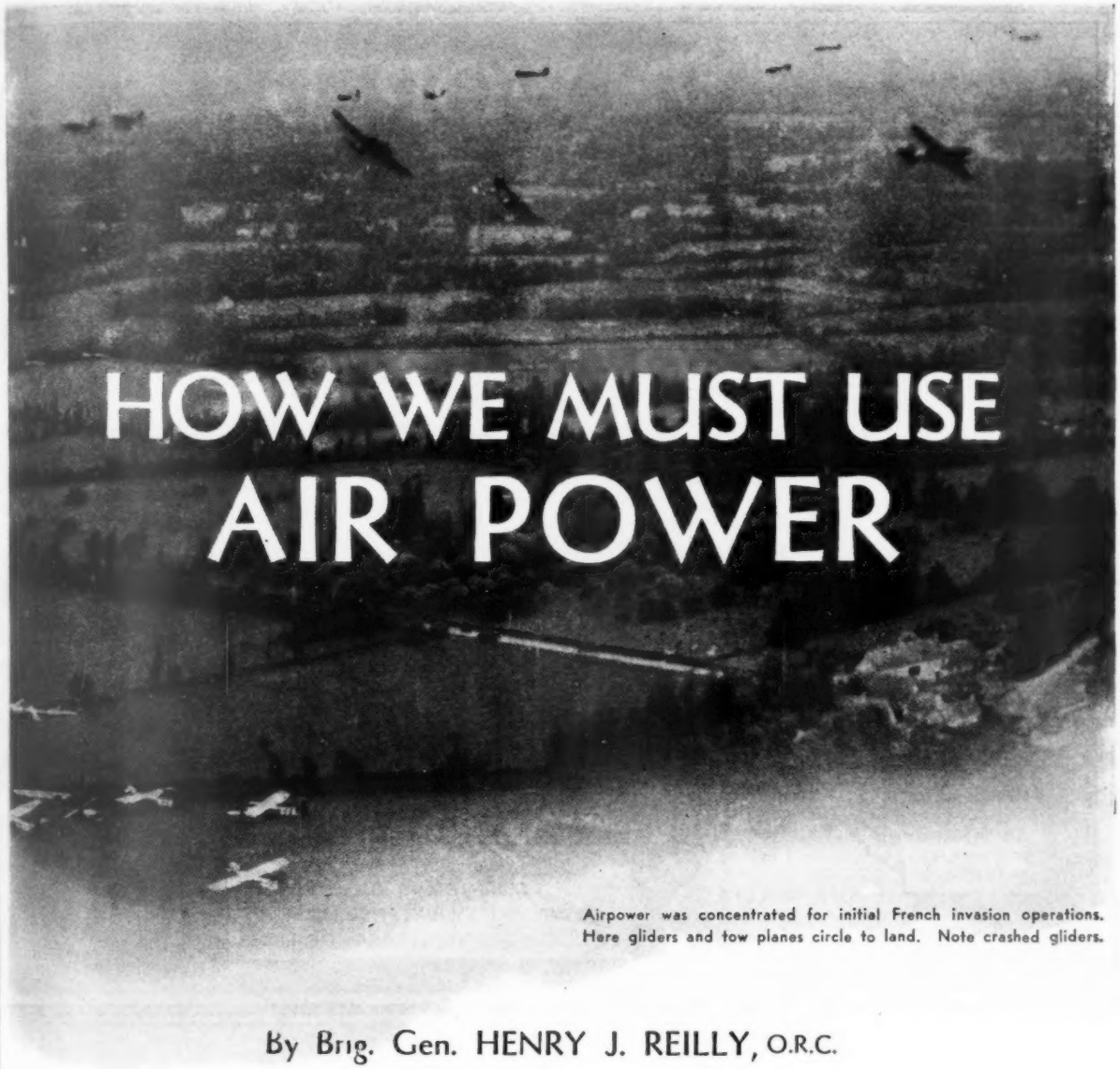
MOST versatile of all non-tactical aircraft in the U. S. armed services, the Model 18 Beechcraft twin-engine all-metal monoplane has been produced for the U. S. and allied governments in five distinct special-purpose types, ranging from high-altitude photographic to bombing and navigation trainers, and command personnel and utility transports. Fifteen variations of these types have been built for specialized uses.

The Army Air Forces AT-7 Beechcraft navigation trainer, for example, has been produced in large quantities as a landplane, and has also been factory-built as a seaplane or ski-plane, using streamlined Edo floats or Noorduyn skis. Quickly convertible from a landplane to a seaplane or ski-plane, this type has fulfilled exacting special duties in Alaska and the far North, and elsewhere. Precedents for these uses were established years before the war, when the commercial Model 18 Beechcraft won great favor with Canadian airlines and other users who required fast, all-season transportation above the trackless bush country to mining and fur trading outposts sometimes well north of the Arctic circle. Landings were made on tree-fringed lakes, and on the open waters of Hudson's Bay and the Arctic Ocean. Its commercial users were exacting in their requirements; its military users are even more exacting.

Beechcrafts are doing their part, in war as in peace, in all parts of the world, in every climate, and under all conceivable conditions of flight.

Beech Aircraft CORPORATION

BEECHCRAFTS ARE DOING THEIR PART WICHITA, KANSAS, U. S. A.



HOW WE MUST USE AIR POWER

Airpower was concentrated for initial French invasion operations. Here gliders and tow planes circle to land. Note crashed gliders.

By Brig. Gen. HENRY J. REILLY, O.R.C.

Decisive victory demands concentration of aviation fire instead of its dispersal, says author analyzing invasion.

THE airplane is not a new weapon. It is not a weapon at all. It is an armed weapon-carrier. An armed airplane is a new means of delivering fire upon an enemy. An unarmed airplane is simply a new means of transportation.

The whole importance of the airplane, when armed, depends upon the effectiveness of the fire its weapons deliver and upon the importance of the target chosen for this fire.

If the destruction by fire of the target chosen is the best means of bringing victory, then aviation has been used to the maximum advantage. If the target chosen is not in this class, then aviation has not been used to the maximum advantage. If the target chosen cannot be destroyed by aviation fire, then the aviation used has been wasted.

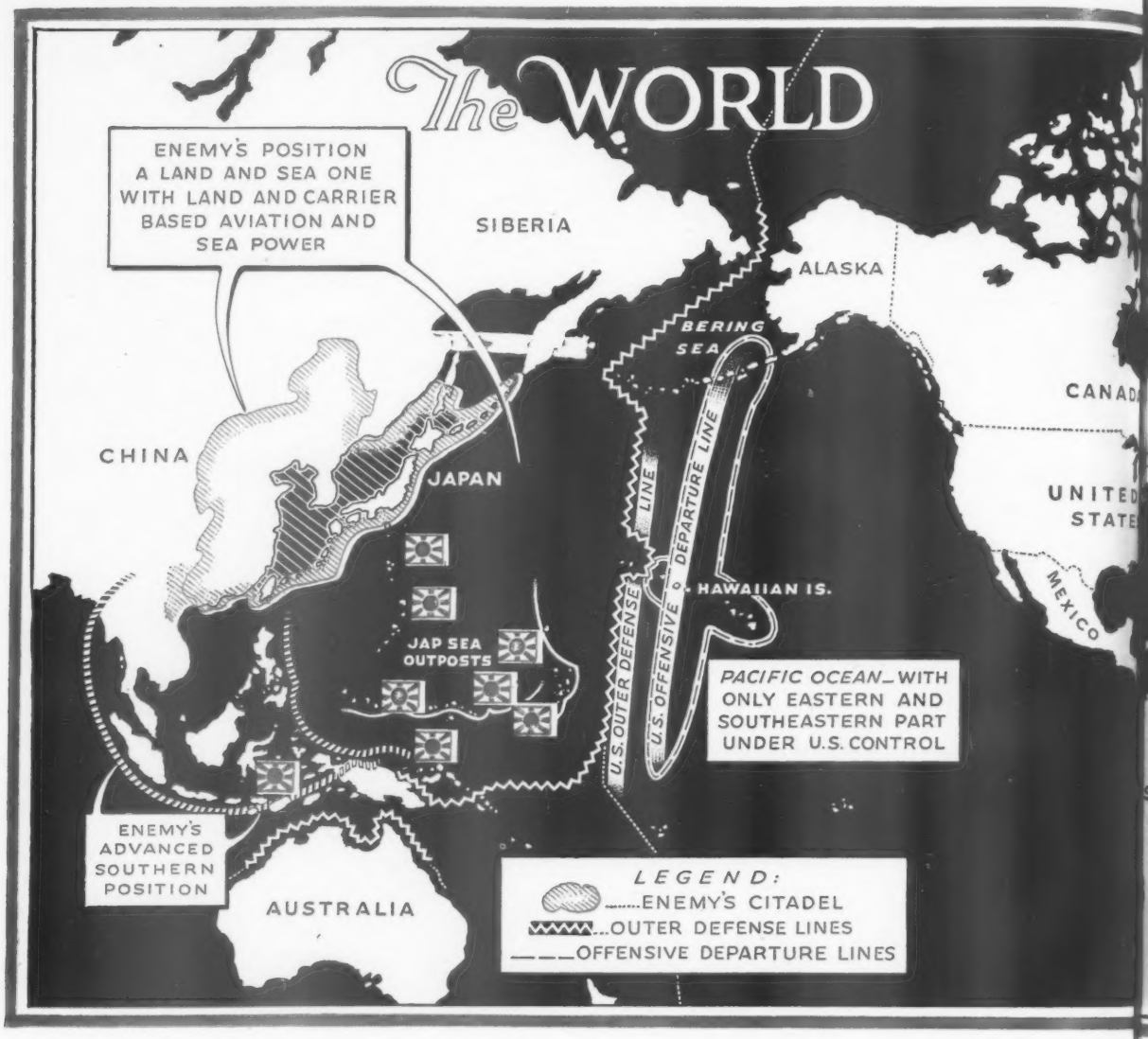
Napoleon said: "Fire is everything; the rest is nothing."

Expanding on the theme he discussed in FLYING last February, that our airpower is being misused by failure to concentrate it in support of ground troops, General Reilly here analyzes our use of aviation in recent invasions. He argues that in the European war theater we disperse aviation firepower; in the Pacific we use it properly. While FLYING does not necessarily agree with all his ideas, it feels that General Reilly's views should be heard respectfully.
—The Editor.

He did not scatter his fire; he concentrated it. His principle was that the destruction of the enemy's armed forces was the quickest and surest road to victory.

Were he alive today, he undoubtedly would welcome the addition to his firepower of the powerful aviation fire. He would undoubtedly follow his principle of concentrating his fire of all kinds on the enemy's armed forces during battle.

Douhet, on the other hand, believed that aviation fire should be used to attack widely scattered targets—these targets preferably being the means of mobilizing armies and navies and of arming, equipping, supplying and transporting ground troops.



These two opposing theories are being tested on a mighty scale in war today. In our Pacific war theater, the commanders of aviation are largely following the principles of Napoleon. In the European theater they are largely following those of Douhet. This writer contends that the principles of Napoleon are proving more successful than the theories of Douhet.

The air problem in our Pacific operations is far more difficult than that in the European and Mediterranean war theater. Yet it is being solved better

In the Pacific, because of the vast distances which must be covered, we must capture base after base from the enemy if we are to use land-based aviation against Japan itself. To capture such bases we must use triphibious forces made up of ground troops, carrier-based planes and warships.

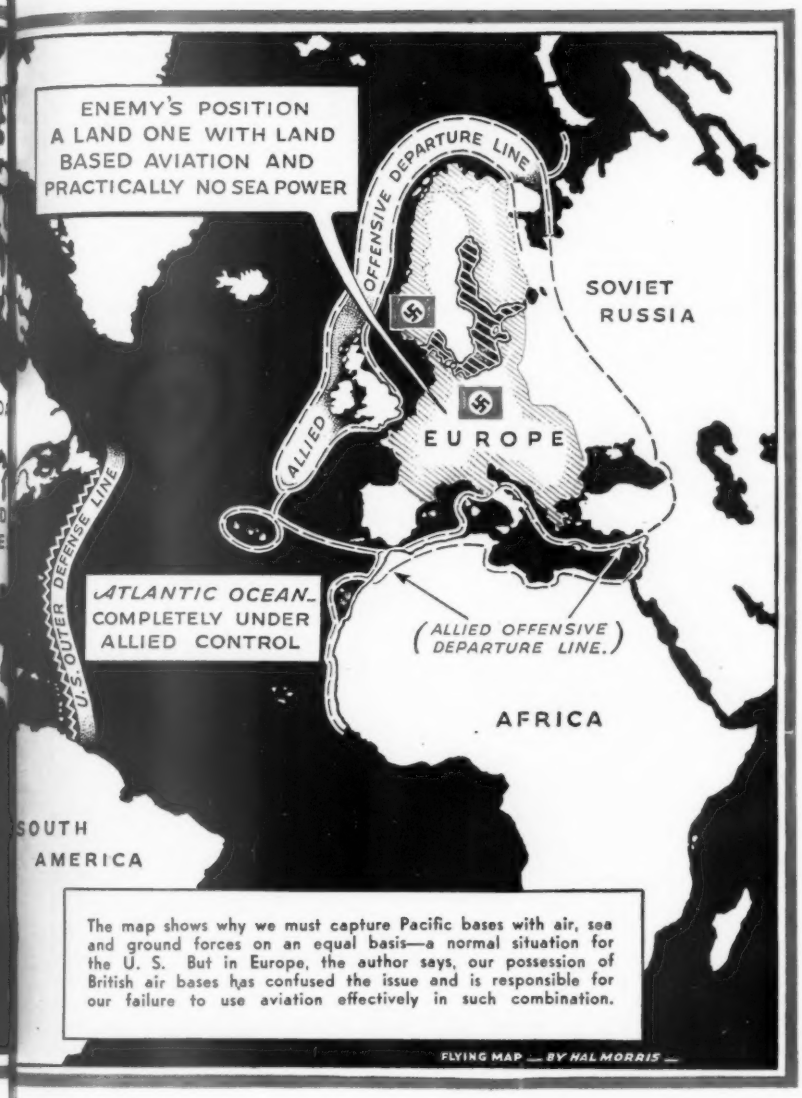
In the European theater, the question of sea-based planes is subordinate because Great Britain, our main base for landplanes, is only a short distance from the enemy. In the Mediterranean theater, our bases in North Africa, Sicily, Corsica and Italy are only a short distance from the enemy, while the aviation of our Russian allies is face to face with that same enemy for hundreds of miles along a land front. In these theaters, Navy surface ships and submarines play a small part by comparison with the ground forces.

In the war against Japan, we have the typical situation for the United States, today and in future wars. From the United States as a base, we must cross an ocean to get at the homeland of any European or Asiatic enemy in order to defeat him decisively. Conversely, an Asiatic or European enemy must cross an ocean to get at our homeland.

The present operations in Europe are not typical of this problem because, with Great Britain on our side, the combined naval forces of the United States and Britain are far superior to those which can be brought to bear against us in the Atlantic. The Atlantic is in our hands. and our line of departure for operations against the enemy's homeland is along the shore line of Continental Europe instead of our own shore line.

The operations in Europe are a special case and not typical of what the United States must ordinarily meet in war (see map). The Pacific situation shows clearly what strategy and tactics we need. We are accustomed to thinking in terms of such situations because of our geographical position. But in the Atlantic theater we already have land bases, especially for our strategic aviation, while in the Pacific we must capture such bases. The special European situation has only confused the issue. In military operations on the continent of Europe we should use the air strategy and tactics which have already proved so successful in the Pacific.

From the evidence to date, it is possible to conclude that, although improvements have been made, the use of air in triphibious operations in the European-Mediterranean area does not yet come up to



The map shows why we must capture Pacific bases with air, sea and ground forces on an equal basis—a normal situation for the U. S. But in Europe, the author says, our possession of British air bases has confused the issue and is responsible for our failure to use aviation effectively in such combination.

the standard set in the Pacific area.

We landed in North Africa in the face of relatively slight resistance. In Sicily we only had to overcome the resistance of a few Italian divisions which apparently intended to give only a token resistance, and a few German divisions left to fight a rear guard action. At Salerno, we again had considerable difficulty and only reached Naples, 20-odd miles away, more than 20 days after we had landed.

At Anzio, we got ashore but were unable to expand the bridgehead and flank the Germans from the Cassino line as we had planned. All parts of the bridgehead were constantly under German artillery fire. Probably only the fire of our warships kept the Germans from driving us back into the sea.

In none of these cases did our airpower give such direct support to our ground troops as the Russians give theirs.

As was true of our landing in Africa, the planning and staff work for the landing in Normandy was excellent. Despite the enemy's fire, everything worked smoothly and landings were effected upon a number of beaches. One of these beachheads was almost lost but was finally held and successfully expanded. The original dispatches indicated that there had been successful landings on our left, between the Orne and the Seine. If so, they were subsequently lost because the beach from the mouth of the Orne to the Seine is not in our possession at the time of this writing.

The enemy is reported to have had local reserves consisting of two infantry divisions and one armored division with their field guns, antitank and antiaircraft artillery and guns.

Without the supporting fire from our warships, it is doubtful if our landing could have succeeded. Since the country mounts in various degrees as the troops proceed inland, our Naval artillery, despite its flat trajectory, could lend fairly close support to our advancing ground troops. This Naval artillery, particularly the large caliber guns, furnished the principal answer to the enemy's coast defense cannon.

A tremendous amount of aviation was present. There is no doubt but that a considerable amount was needed to keep the skies clear of enemy aviation. On the other hand, a much larger proportion of this force of aviation could have been used for a direct attack upon the enemy guns, troops and tanks brought up in increasing numbers.

Later, in the attack which ended in the surrender of Cherbourg, 1,000 planes, as well as all available artillery ashore, were used to produce a concentration of fire which, from available reports, was a far greater concentration than used at any time during the landings. Long range strategic bombing was apparently not resumed for several days after the landing. When it did resume it meant a proportionate diminution of air support for the troops ashore struggling forward.

While our right pushed across the Cotentin Peninsula and cut off and captured Cherbourg, our left has made little material advance since the end of the first few days except for the British capture of Caen, which was once reported captured a few hours after the landings.

If any evidence were needed of the necessity to concentrate both artillery and airpower in attacking strong points, it is furnished by the capture of Caen, where General Montgomery followed the tactics he used at El Alamein, and turned a concentration of both artillery and aviation fire on the enemy.

The situation on our left has been due to the enemy's fire being concentrated to a greater extent in this region than has been the case on our right. In the first place, the enemy's coast defense batteries in the Le Havre neighborhood can fire not only into our left flank, but also into the left rear of that flank. Enemy coast defense batteries on the south bank of the mouth of the Seine can fire into the ships and landing craft of all kinds necessary to supply our left flank.

If we concentrated all the aviation obtainable against the enemy's coast defense batteries and ground troops as the primary objective, German resistance on our left could be eliminated by our ground troops capturing these batteries, occupying Le Havre, and opening up the mouth of the Seine for our shipping.

If the tremendous firepower of the aviation engaged in bombing Germany could be used against the German armed forces on the Normandy battlefield, it would quickly bring a decision in our favor.

Our latest Pacific success, the capture of Saipan, is a striking example of the victory which always ensues when all means of fire are concentrated on the enemy's armed forces and not dispersed as in Europe.

The enemy's armed forces consisted of the troops with land-based aviation on the island of Saipan and part of the Japanese fleet, with its carrier-based aviation which was sent to attack our Navy vessels and their convoy of transports. There was no question of dividing our

(*Continued on page* 142)

JET BOMB

By KENNETH R. PORTER

Flying's European War Correspondent

An Air Base in Southern England

HITLER'S first post-invasion secret weapon, the flying bomb, is the most unorthodox gadget of the war. Apparently a contraption of little direct military consequence, it is being used to inflict damage and casualties—chiefly in the London area. Its damage, though often serious, is haphazard and it is already recognized chiefly as a psychological weapon. Blitz-hardened Britains have nicknamed the jet-propelled bombs everything from "pilotless planes" to "doodle-bugs." They are known officially as flying bombs.

England was not unprepared for the robot attack. In his speech of July 6—the first break in rigid English censorship on the effect of the aerial bombings—Prime Minister Churchill pointed out that the serious danger of this form of attack had long been recognized in secret circles of the British government. In fact, British conjecture on the danger was considerably in excess of what actually happened.

In outlining the counter-measures undertaken to mitigate such attacks, Prime Minister Churchill stated that early in 1943 intelligence units began to sift vague reports that the Germans were developing a new long-range weapon with which they proposed to bombard London. Continual and intense study was made of all reports and the chiefs of staff and war cabinet were kept constantly advised as to counter-measures. Street shelters were strengthened generally, additional underground shelter was readied.

Even as early as July, 1942, searching investigations by agents and air reconnaissance had succeeded in locating the main experiment station both of the flying bomb and the long-range rocket. Subsequent reconnaissance flights located about 100 somewhat smaller sites all along the French coast between Le Havre and Calais. It was concluded that these installations would be firing points for a jet-propelled projectile which was smaller than the rocket of which intelligence sources had first warned. All of these 100 firing points were continually bombed, beginning last December, and every one of them destroyed by the RAF with the assistance of growing United States airpower.

As new installations were made, they too were subjected to continuous attack. Prime Minister Churchill stated that by July 6 "the total weight of bombs so far dropped on flying bomb and rocket targets, including Peenemuende and other places, has now reached about 50,000 tons"—almost 20 times the tonnage launched in the German robot attack. "The hundred firing sites which were destroyed," the Prime Minister added, "assuming the enemy production of missiles was adequate, could have delivered a vastly greater discharge of high explosives on London than those which we have now."

Most unorthodox of Nazi war weapons, jet bombs were not quite the surprise that enemy strategy had planned.

Mr. Churchill readily admitted that "these efforts have been exacting to both sides, friend and foe, and a quite considerable proportion of our flying power has been diverted for months from other forms of offensive activity. The Germans for their part, had to sacrifice a good deal of manufacturing strength which could have increased their fighter and bomber forces working in conjunction with their hard-pressed armies on other fronts."

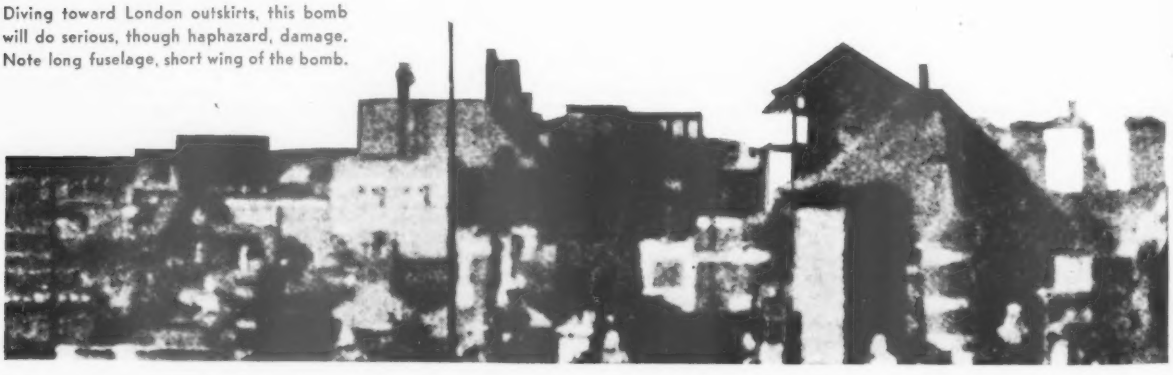
In striking the balance in such expenditure of effort, it is of value to know the intricacies involved in manufacturing and operating the flying bomb as well as its effectiveness.

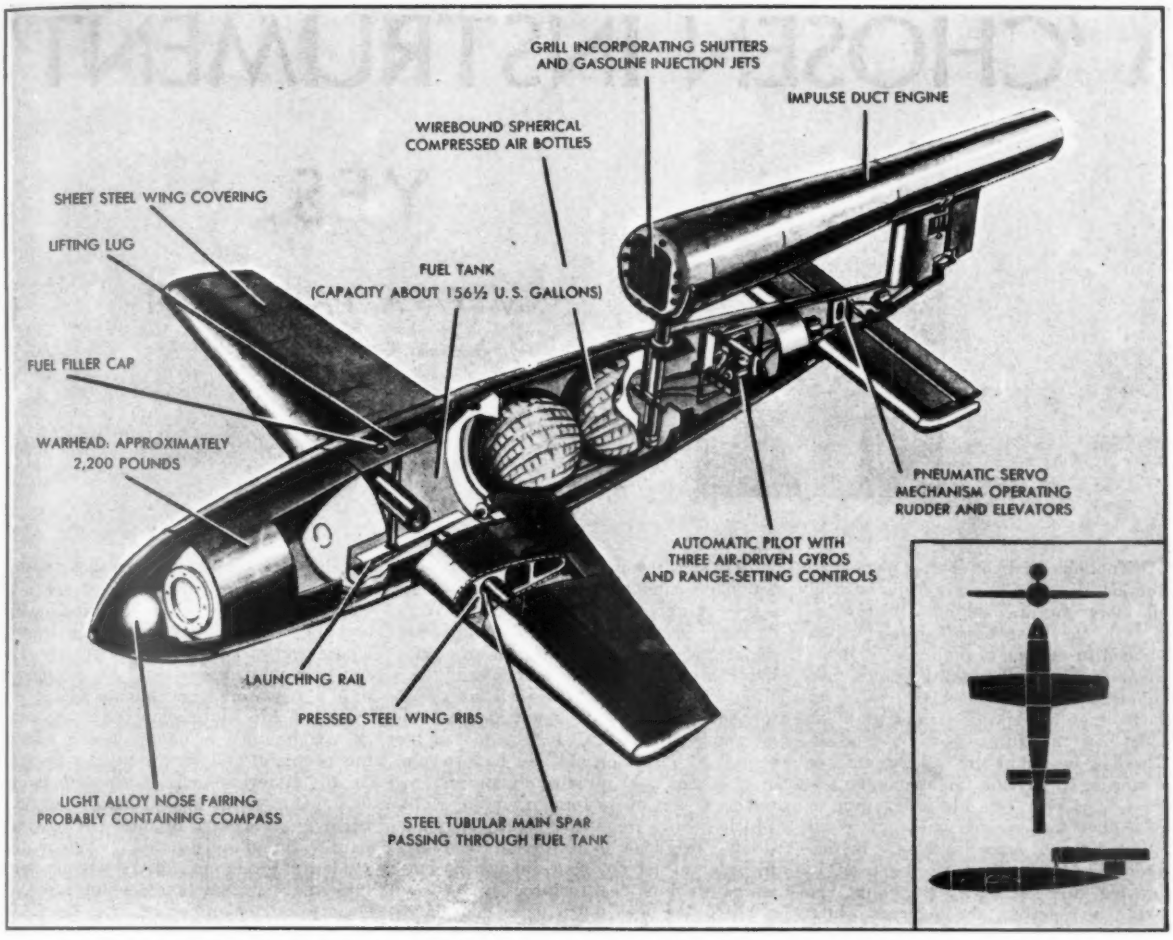
They possess none of the maneuverability, control or accuracy of an airplane. The flying bomb resembles in appearance a pint-size plane, but upon inspection it is seen to be nothing more than a winged, long-range artillery shell, whose flight is achieved by jet-propulsion.

The mechanical construction and the operational technique of the jet-propelled bomb lends little credence to the mythical accomplishments accredited to it by its designers.

I have seen flying bombs at comparatively close range traveling at speeds which were estimated at 300 m.p.h. by pursuit pilots preparing to knock them out of the sky. They were doing a straight and level under full throttle, purring with a rhythmic note rather like that of a two-stroke gasoline engine. This peculiar sound is easily distinguishable and can be heard above natural motor traffic noises. The "buzzing noise" serves as

Diving toward London outskirts, this bomb will do serious, though haphazard, damage. Note long fuselage, short wing of the bomb.




GRILL INCORPORATING SHUTTERS AND GASOLINE INJECTION JETS
IMPULSE DUCT ENGINE
WIREBOUND SPHERICAL COMPRESSED AIR BOTTLES
SHEET STEEL WING COVERING
LIFTING LUG
FUEL TANK (CAPACITY ABOUT 156½ U.S. GALLONS)
FUEL FILLER CAP
WARHEAD: APPROXIMATELY 2,200 POUNDS
PNEUMATIC SERVO MECHANISM OPERATING RUDDER AND ELEVATORS
AUTOMATIC PILOT WITH THREE AIR-DRIVEN GYROS AND RANGE-SETTING CONTROLS
LAUNCHING RAIL
PRESSED STEEL WING RIBS
LIGHT ALLOY NOSE FAIRING PROBABLY CONTAINING COMPASS
STEEL TUBULAR MAIN SPAR PASSING THROUGH FUEL TANK

Cross-section cutaway drawing of most common Nazi flying bomb. It is 25 ft. 4 in. long and is mostly made from pressed steel.

identification for people who wish to seek refuge in shelters.

They are undeniably an infernal nuisance because a person cannot run to a shelter every time during the day and night that they approach.

Mr. Churchill has pointed out to the English people that "this form of attack, no doubt, is of trying character, worrisome character, because it is being spread out over the whole 24 hours." In estimating the damage done, he reported that up until July 6 a total of 2,754 flying bombs had been launched and 2,752 fatal casualties sustained, an average of about one person killed per bomb. "A very high proportion of these casualties," he said, ". . . . have fallen upon London, which presents to the enemy—now I have mentioned it the phrase (southern England) passes out of currency—a target 18 miles wide and, I believe, over 20 miles deep."

For those who have not yet met this monstrosity at close quarters it presents all the eerie mystery of a ghost story. People stand gaping skyward while one screams overhead, observing it with a mixture of awe and skepticism.

Personally, I show due respect for them

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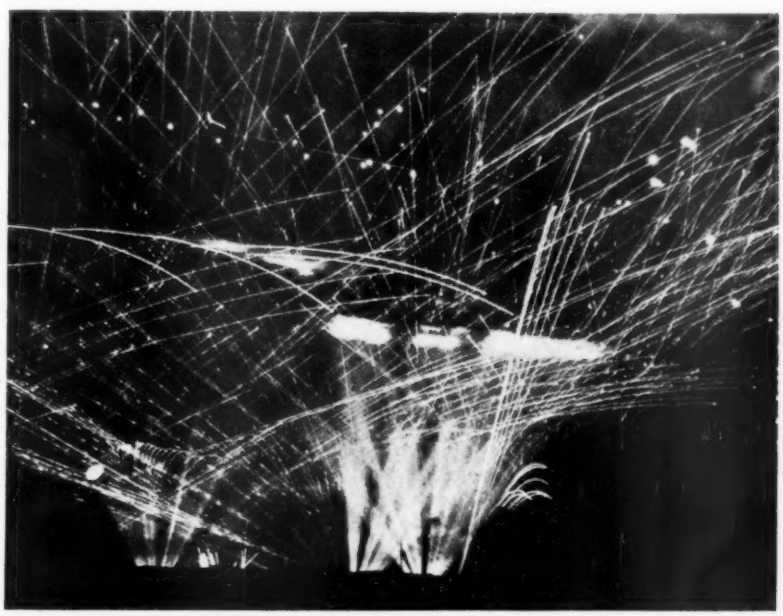

English coastal defenses catch a flying bomb in their web of searchlights and flak. The thin casings of the bombs make them highly vulnerable to AA and even machine-gun fire.

A 'CHOSEN INSTRUMENT'

YES,

Says W. A. PATTERSON

President, United Air Lines, Inc.

THIS nation's airlines, today on a firm foundation after 20 years of pioneering development, are looking a bit breathlessly at the vast opportunities which lie ahead in the age of flight. And, d monstrating the individuality which has characterized them in their years of growth, they are taking various views as to just how that future is to be handled.

There is no doubt that all the airlines are sincere in striving for a common objective—the best possible utilization of the airplane as an instrument of world progress in the years to come. In disagreeing as to methods to be used in achieving this goal, they no doubt are seeking and getting the answers which ultimately will result in sensible policies and a logical pattern of airline operations, domestically and internationally. Right now, they simply are in the throes of some extremely complicated thinking and planning, with too few precedents on which to rely and with obvious difficulty in estimating what lies ahead.

It has become trite to say that air transportation is on the threshold of tremendous growth; that it holds great promise as a vital force for good. Everyone acknowledges these facts.

Certainly, the airlines will open up vast new areas and new resources. They will make near neighbors of cities around the globe and will, if properly administered, promote international understanding and good-will. Those words "if properly administered," however, should be carefully noted.

Today, every nation with imagination and resourcefulness is raising eager eyes to the sky. Already, while we still are busily engaged in winning a war, we hear rumblings of international covetousness and greed. Nations are beginning to argue as to what bases belong to whom, what routes are to be flown by what operators. All seem determined to have their share—and perhaps a little more—of that sky above.

It seems to me that if we in the airline industry are to attain our common objective we have to do a little serious thinking on the unemotional side. Postwar plans cannot wait until peace arrives —they must be taking shape now. And it would seem that the kind of international understanding which we are seeking also could begin here, today.

We can be sure that the air is not going to belong exclusively to any one nation or group of nations. It is going to be shared by all. The old and honest rule of give and take must apply if such be the case. For every foreign landing right which we ask, we must be ready to give a similar privilege to a foreign operator. In order to get our share of world commerce, we must deal reciprocally.

There has been much loose talk about "free, wide-open competition" on the world's air lanes. Domestic airline operators, having had a liberal taste of international flying on military routes during the war, have a natural desire to keep on flying over the oceans and continents. They have demonstrated—and ably—that the airplane can go everywhere and anywhere. They see no reason now why they should be restrained in any way from international flying.

United Air Lines some time ago suggested that one or more chosen instruments might well represent this country in the international transocean flying field. Our stand, set forth in a comprehensive statement to the Civil Aeronautics Board and backed up by detailed studies of economic experts, has not been altered by any current developments.

As we stated in our letter to the CAB, we believe U. S. aviation has two main objectives: (1) to maintain the rank of its flag on the international airways and

(*Continued on page* 148)

Chief proponent of the "chosen instrument" policy, with United Air Lines, is Pan American Airways. Here is Pan Am's Dinner Key Airport at Miami, for international air commerce.

AIRLINE?

NO,

Says RALPH S. DAMON

Vice president and general manager, American Airlines, Inc.

Two distinguished airlines executives disagree on international air policy.

RAPID transportation has always promoted a broader community of interest, a deeper sympathy and understanding among people and increased respect for the other fellow's point of view. The successful integration of our 48 states is an outstanding example of the removal of regional misunderstanding and a tribute to transportation. If we are to make a better world as a result of the cataclysm through which we are now going, we must do the same thing on a world-wide basis, and aviation is the agency which can do it. A splendid start has been made in international aviation relations through the services now provided for our neighboring republics, Canada and Mexico.

Aviation is about to establish itself as a commonplace means of rapid transportation between continents. Our domestic airlines, in serving the Army Air Transport Command and the Naval Air Transport Service, have proven beyond question that they are ready, willing and able to transform their military services into commercial projects at the conclusion of the war.

Proponents of the one-company "chosen instrument" theory would like to foist a monopoly upon the domestic airlines and thereby stifle any American competition in overseas flying. They can hardly be blamed for defending a unique position which has been theirs for so many years, but they should rid themselves of the apprehension that they might lose some of the routes which they have pioneered and maintained. If such fear is the basis of their argument for monopoly they are mistaken. While 17 of the 19 airlines have issued a joint statement of policy which calls for regulated competition, at no time have those 17 airlines wished to see anyone robbed of routes regardless of what area of the oceans and continents they cover.

The proponents of the "chosen instrument" monopoly theory have either deliberately or unintentionally overlooked the fact that only a minority of those 17 airlines is considering entering commercial trans-oceanic service. Only a few of that group have such applications filed, as records of the Civil Aeronautics Board will show. Probably not more than three or four of the domestic airlines will establish transatlantic service, and maybe only two will fly transpacific for a long time to come. Ironically, one of those airlines to fly transocean routes will undoubtedly be the sole domestic airline now so enthusiastically propounding the chosen instrument theory.

There will be no pell-mell rush into the transoceanic business. Permission to establish service must first be granted by the Civil Aeronautics Board, and if the thought and consideration which the Board in the past has given to stimulating our domestic airline system in a well regulated manner is any criterion, then our transoceanic air service will enjoy healthy and regulated competition.

It is unthinkable that our country, which owes its growth, its greatness and its world leadership to the simple American fundamental of freedom of enterprise and private initiative, would ever be content to foresake that fundamental ideal. But on the remote supposition that our country should forsake its birthright for the theory of the "chosen instrument" monopoly, then the growth of air transportation will suffer. Competition and the efficiency which naturally is evolved from competition are much too valuable to be discarded for a theory which would do nothing but stunt America's growth as an airfaring nation.

It is elementary but basically sound to point out how retarded the expansion of our frontiers would have been had the

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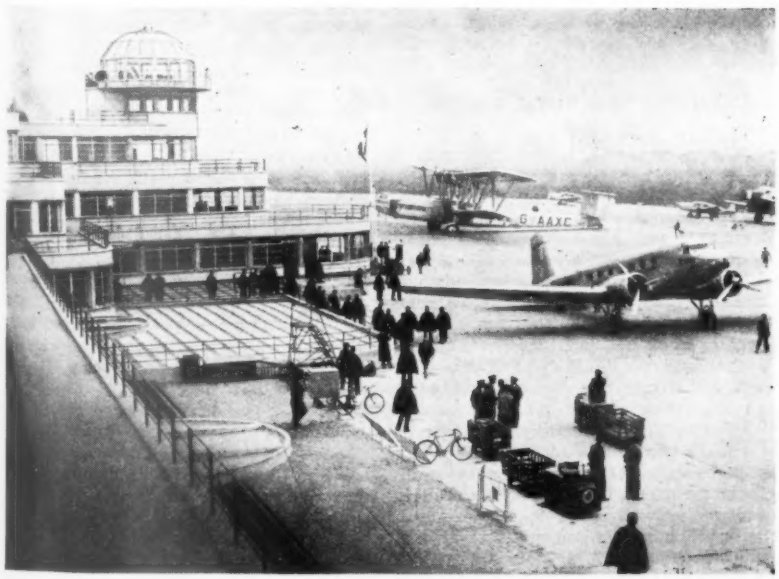


Pre-war LeBourget Airport, Paris, France. Will U. S. commercial planes landing on this field in post-war years be flown by a "chosen instrument" airline or by several competing airlines?

Inter-American Training Program has been a success, as these Uruguayan and Peruvian officers at Corpus Christi can attest.

WORLD CPTP?

By FRED HAMLIN

FLYING'S Washington Editor

Plans are being formulated to train in the United States flyers and aviation mechanics from all over the world.

ONE of the most significant educational programs of today—if not of all time—is being fashioned in Washington under the combined leadership of private industry and the Federal Government.

It is an outgrowth of the co-operation that made possible the Inter-American Aviation Training Program, which in the past 2½ years has given flight or mechanical training to more than 700 picked South Americans. The new program will have the nation for its campus, the factories and business offices of the United States as its classrooms, and crack students from all over the world as its pupils.

According to plans now crystallizing, private industry will accept increasing responsibilities in connection with the work. The Aeronautical Chamber of Commerce and the Air Transport Association have already taken an active part in laying the foundations for the aviation aspects of the program, and active participation of the membership was assured recently when Harold G. Mosier of Glenn Martin—representing the ACCA—was elected chairman of a committee to work out a program, while an ATA representative, Victor Vernon of American Airlines, was made vice-chairman.

Symbolizing the co-operation between Government and business, Martin Taitel, economic consultant of the Civil Aeronautics Administration, was made the committee's secretary. Mr. Taitel has been active in the work from its inception early this year, when he was loaned by CAA Administrator Charles I. Stanton to work out details.

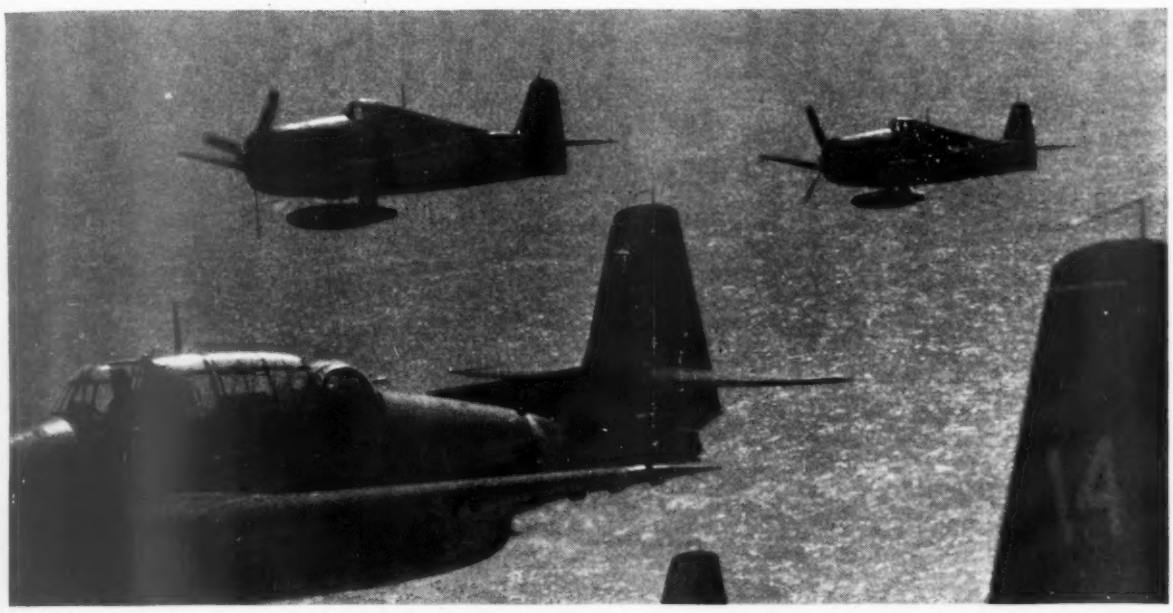
State Department will be represented by its aviation division. Elliott Hanson, who was borrowed from U. S. Steel in 1940 to head the Inter-American Training Administration of the Co-ordinator of Inter-American Affairs, will also be a member. The Administration under Mr. Hanson has done an outstanding job on trade scholarships and similar trade-in-industry activities.

Credit for the new set-up, however, goes to Mr. Hanson and, for its aviation aspects, to William A. M. Burden, Assistant Secretary of Commerce, who started work on the world-wide program following a request from Assistant Secretary of State Adolf A. Berle early in the year.

The Civil Aeronautics Administration, as part of the Department of Commerce, has been doing the actual training of pilots, mechanics and technicians for South Americans since 1941 under Mr. Stanton in response to requests from the State Department and the Co-ordinator of Inter-American Affairs.

(*Continued on page* 100)

HOW WE BEAT THE ZERO



Hellcat fighters flying escort for Grumman Avengers provide protecting cover and never let themselves be drawn off in mass dogfights.

By Lieut. Comdr. E. SCOTT McCUSKEY, USNR

Finding their Wildcats outperformed by Jap Zeros early in the war, Navy pilots began developing amazing new tactics.

THIS story goes back to the day when the bad news of Pearl Harbor began to filter in over the radio of the old *Yorktown*. We heard that the Japs were hitting everywhere with their Zeros, and we tried to evaluate the fearsome reports of the unbelievable climb, speed, and firepower of that mysterious airplane. We knew that our little lady, the *Wildcat*, was all we had. Before we started for the Pacific, plane crews worked day and night in Norfolk making the first installations of armor plate, self-sealing tanks, adding radio equipment and guns. Under the load, our poor little *Wildcat* lost much of her maneuverability, speed, and climb—the things for which she had been designed. However, we gained the protection that was to bring us back from many a battle.

Few fighters in the fleet realized that our planes weren't good enough to dogfight the Japs; the last we'd heard, the Nips were pretty far behind the times. Our tactics against fighters at the beginning of the war were built around individual combat and on the assumption of our superiority in this department. In training maneuvers we scored victories, technically, by turning inside our opponent and getting on his tail or by outclimbing him and pouncing down in a gunnery run, preferably from fore or aft. These tactics assumed the superiority of our own planes in turn, climb, and speed.

Moreover, such tactics assumed that we were better flyers and marksmen. This proved true, thank God! Unbelievably thorough drills on the gunnery sleeves, practicing deflection runs from every practical angle of fire—that's how Lieut. Comdr. "Butch" O'Hare, Lieut. Comdr. "Swede" Vejtasa and some of the other high-score boys were able to cut down bombers the way they did.

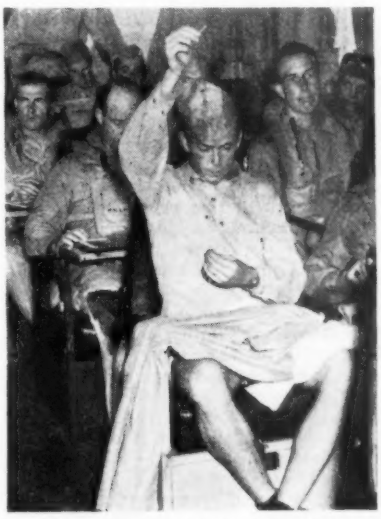
They shot with deadly accuracy from wherever the enemy's free guns were blindest.

According to the "book" by which we got our early training, the fighting squadron had been organized around the three-plane section as a basic unit, maneuvering in six or nine-plane divisions. The three planes of the section flew in a V and one of the commonest formations was for the sections themselves to go into a "V of V's"—the nine planes of the second section bringing up the rear to form a double-header V, like a corporal's chevrons. On parade it was very very impressive.

For attack, six planes would string out in echelon, like half of a V of ducks. Fighter after fighter peeled off, leader first, to dive on the enemy. From then on it was a matter of individual combat, each plane making a run on a plane in the enemy squadron until the fracas was over and all pilots in the division joined up on the leader again.

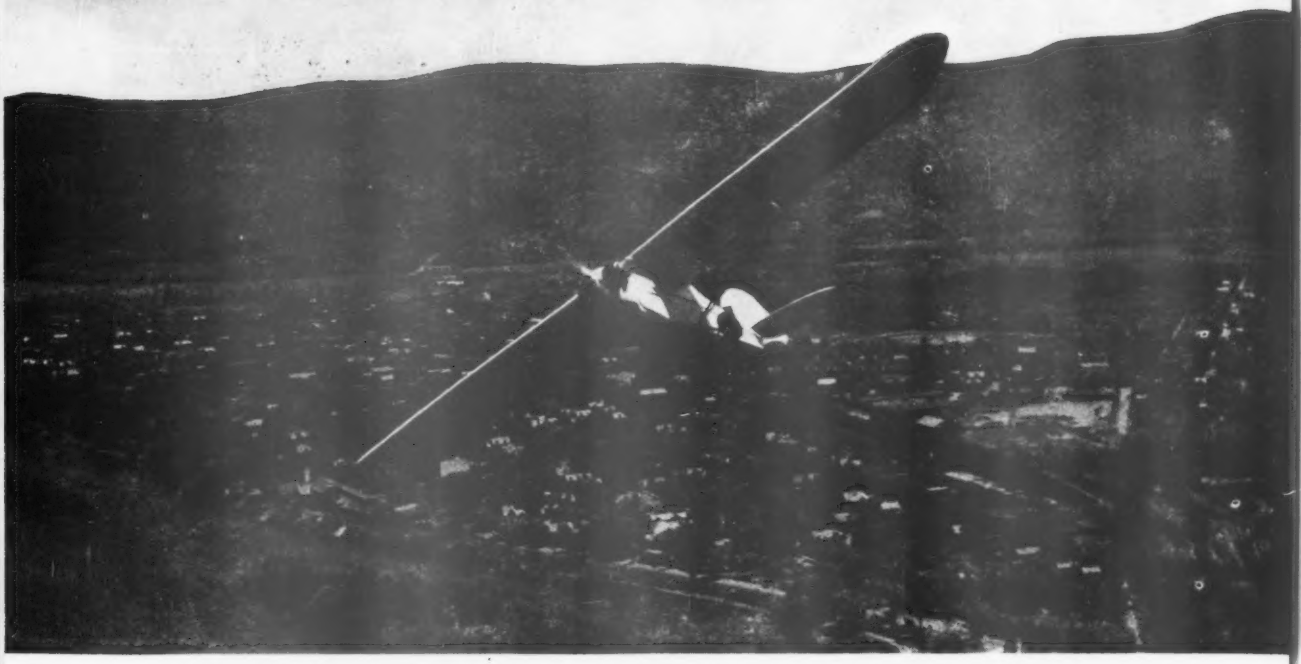
At the time the war began, some squadrons had gone over to the more flexible two-plane section, but there was still lit-

(*Continued on page 94*)



Author does repair job while waiting to be briefed with Hellcat Squadron.

What Was Wrong with PRIVATE FLYING?



Cub over Lock Haven, Pa., dramatizes pleasure that led thousands of pre-war private flyers to purchase their own planes.

By CHARLES E. PLANCK

Investigators point way to post-war planes by finding that pre-war flying was too expensive, lacked utility.

THE average private plane owner in pre-war days retained ownership of his aircraft less than four years, and more than half of the owners retained their planes less than two years. There are two major reasons for this comparatively small span of ownership—high cost of operating lightplanes and limited utility.

These facts have been revealed in the first section of a report to William A. M. Burden, special aviation assistant to the Secretary of Commerce. Authors of the report, which sets the stage for an inquiry into the post-war outlook for private flying, are John H. Geisse, CAA's private flying enthusiast and expert, and Samuel C. Williams.

For purposes of their study, Geisse and Williams arbitrarily assume that the private plane of pre-war days was one seating two to four passengers and selling for between $2,000 and $10,000, and with an engine of 300 h.p. or less. On that basis, they point out, the private plane accounted for less than $22,000,000, or about 21 per cent, of the total commercial business in air frames and engines for the years 1933 to 1937. Above the $10,000 figure, most planes were in the commercial flying business.

One American in 14,000 owned an airplane in 1929, the peak of private flying up to that time and two years after the Lindbergh flight which helped make America aviation-conscious. In 1929 and 1930, private flyers flew 110,000,000 plane-miles and carried 2,200,000 passengers in privately-owned planes. Then came the depression.

By 1934, there were 7,800 private planes instead of 9,300, and mileage was way down. Then we took off again and climbed for three years. In 1937, there were 8,900 private planes in use and from there on growth was continuous up to the outbreak of the war. In 1938 there was a "recession" and the volume of private planes suffered a slight setback, but it resumed the upward trend in 1939. By the end of 1941 there were 24,124 private planes.

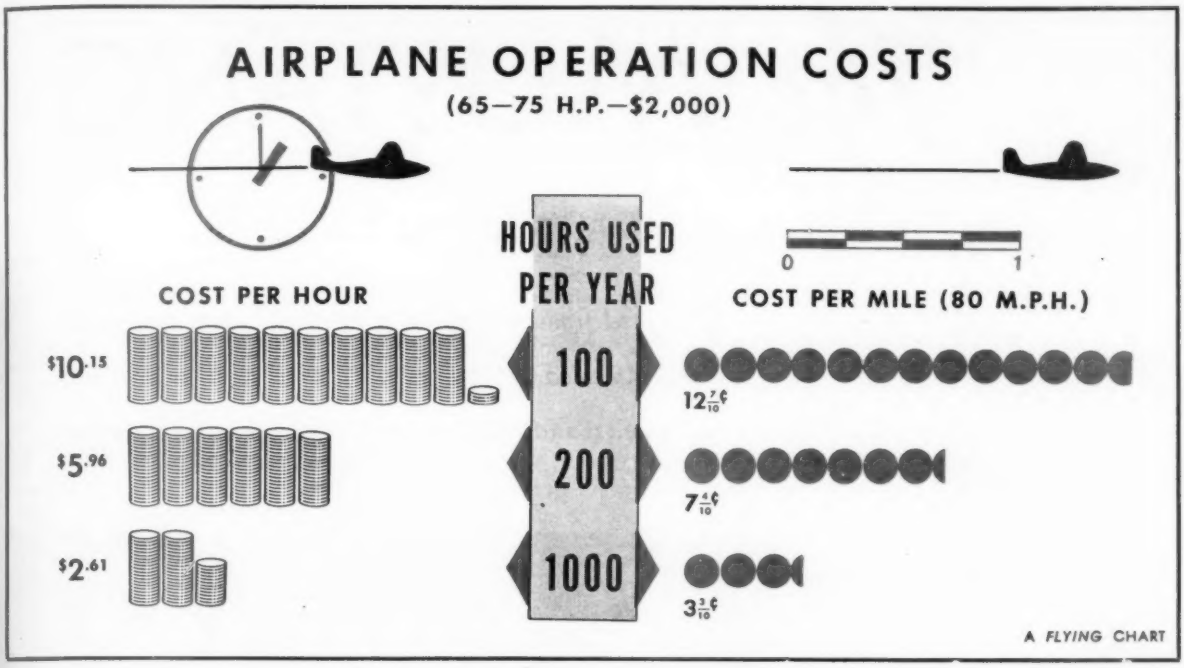
But that's nothing! There were 27,000,000 privately-owned automobiles in this country, one for every four and a fraction persons. In 1942, only one out of every 5,000 Americans owned a private plane.

Many things happened to affect private ownership. Through the years, the Government made two efforts to increase private flying. One of these plans flew head-on into the antipathy of the industry and cracked up. Geisse joins in no arguments, but he does give figures which should clear this project of the bad reputation tacked on it by the industry.

The plan was the Eugene Vidal project for developing a low-priced, safe plane for general private use. Somebody gave it the name, "$700 airplane," and the industry hooted it to death.

But look at the official figures in the Geisse report. In 1935, when the Vidal planes were getting tremendous publicity, 436 lightplanes were manufactured.

"You are ruining us," screamed the



A *FLYING* CHART

manufacturers. "Nobody will buy our planes. They will all wait for your dream plane, and you'll never get one manufactured for $700."

Well, they didn't wait. In 1936, these manufacturers built and sold 889 planes, twice as many as in 1935. The next year, they built and sold 1,523, and in 1938, the recession year, they produced 1,363.

Then in 1939 the Government gave the aviation industry another shot in the arm. This time, it worked phenomenally. Based on its success with an experimental program involving 313 students, the Federal Government proposed to teach American boys and girls to fly.

In 1940, Congress told the CAA to take $4,000,000 and train 10,000 more. Thus began the Civilian Pilot Training Program, conceived by Robert H. Hinckley, assistant secretary for air of the Department of Commerce.

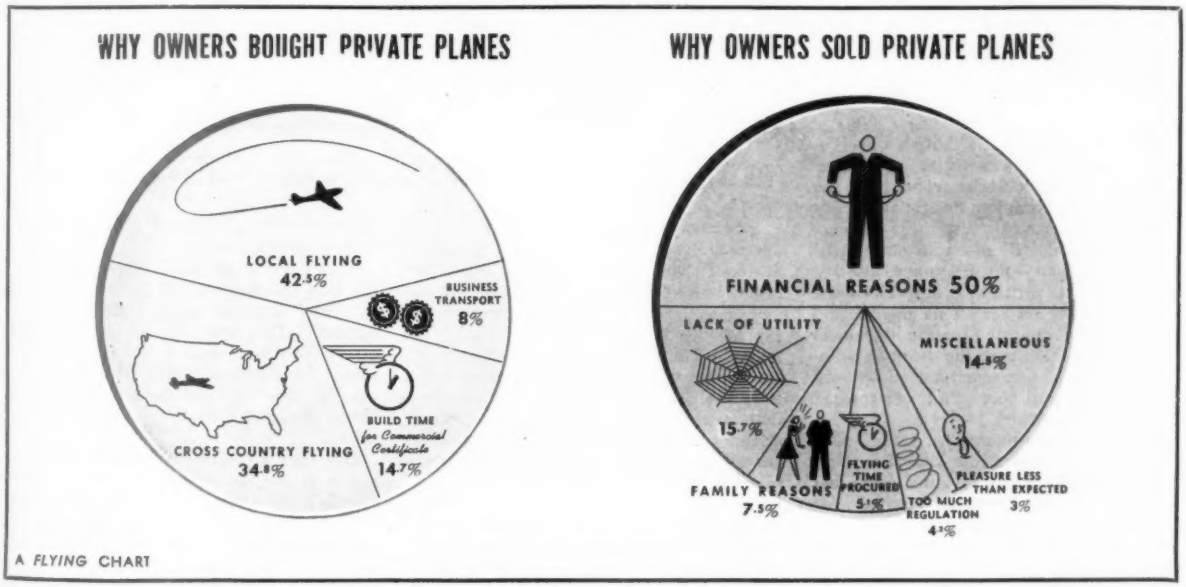
The sale of lightplanes boomed. Many, of course, went to flight operators as trainers but many were bought by individuals who felt the impact of this nationwide program. The production figures jumped to 3,029 in 1939, 4,455 in 1940 and 6,115 in 1941.

And look what happened to the pilot figures. If you eliminate from the student pilot totals of 1940 all the boys and girls who got free training from the Government, the number of student permits issued each year was still two to three times greater than a continuation of the pre-CPT trend would have produced.

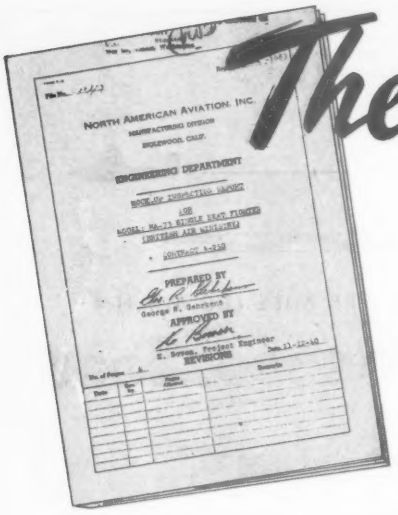
Here is a hopeful sign. When, for any reason, there is increased public attention to private flying, more people learn to fly and more private planes are manufactured. Government "competition" with private industry has proved this twice, just as the stunt flyers of 1927-30 proved it.

Geisse and Williams say that private flying in the past was expensive and dan-

(*Continued on page* 102)



A *FLYING* CHART


NORTH AMERICAN AVIATION, INC.
MANUFACTURING DIVISION
INGLEWOOD, CALIF.
ENGINEERING DEPARTMENT
MOCK-UP INSPECTION REPORT
USE
MODEL NA-73 SINGLE SEAT FIGHTER
UNITED AIR MATERIEL
CONTRACT A-240
PREPARED BY
George H. Gerrbach
APPROVED BY
E. Bowen, Project Engineer
REVISIONS

Mockup inspection report of NA-73 for the British is dated November 12, 1940.

The MUSTANG

By EDWARD CHURCHILL

Designed from scratch for a hurried British order, the North American Mustang has proved itself one of this war's outstanding fighters—and it's getting better.

R. H. Rice
Chief engineer

Edgar Schmued
Chief design engineer

Kenneth P. Bowen
First project engineer

George Gehrkens
Second project engineer

Arthur G. Patch
In charge of wing section

John F. Steppe
In charge of fuselage design

IN THE early spring of 1942, when the North American *Mustangs* went into action as British army co-operation planes, they were untried and unappreciated. Because they performed best near sea level they were passed up as high altitude fighters and assigned to photographic reconnaissance. They skimmed across the English Channel at tremendous speed to map Nazi territory. The combat jobs were getting the glory while they, because of their "hit and run" work, avoided combat.

They swept far inland, photographing thousands of square miles, revealing every possible target. At times they flew so low that they returned with pieces of fence posts, high tension wires, tree branches and miscellaneous rubbish hung on them. The topper came, according to reliable report, when a "recon" pilot whipped in from a photographic mission with a considerable portion of a Nazi soldier's head embedded in the leading edge of his wing.

At about this time the British were becoming aware of the fact that an airplane they hadn't particularly wanted in the first place was proving itself with every sortie.

Then came the Dieppe raid on August 19, 1942. In went the *Mustangs*, fighting at their best altitude—very low—due mainly to lack of sufficient power and adequate supercharging for the high-level work. They mixed with the deadly Focke-Wulf Fw-190's, mastered and destroyed several. In addition, they performed visual reconnaissance.

The sleek, trim planes, with top speed over 400 m.p.h., firing four .50-caliber and four .30-caliber machine guns, were becoming a revelation to the British Air Ministry and to their pilots.

The *Mustang* was not large compared with some combat craft. It had a wing span of 37 ft. 5/16 in.; length of 32 ft. 3¼ in.; height of 8 ft. 8 in., a wing area of only 233.19 square feet and a gross weight of about 8,000 pounds. The British pilots found it highly maneuverable in the air and on the ground. In flight it accelerated rapidly due to its clean lines, flush skin joints and its laminar-flow, low-drag wing. This wing was the first of its type ever installed on a combat airplane. Among its features was a negative angle of attack at the wing tips resulting in an outward travelling stall. Well-balanced controls made it easier to fly than any other combat plane.

On the ground, the wide landing gear—it has a tread of about 12 feet—virtually eliminated any tendency to ground-loop. The tail wheel, steerable within the range of rudder travel, allowed swift and accurate ground travel.

About this time, the British were learning that the plane could be characterized as "the longest range single-engined fighter." This was proved in an aerial attack directed against Dortmund, Germany, in October, 1942. The *Mustangs* became the first single-engined planes based in Great Britain to penetrate Germany.

But let's go back to the beginning to see how the plane got that way. It involves a production rather than a combat struggle, made by the scores of men who toiled so valiantly to perfect and produce the plane on a mass basis long before it had begun to prove itself.

J. H. Kindelberger, president of North American Aviation, Inc., had built hundreds of BT-9's, BT-14's and *Texans*, considered among the finest training planes in the world, and he had started producing *Mitchell* medium bombers in 1939. Early in 1940 he had acquired the "know how" of mass production and of getting things done in a hurry. Early in 1940, therefore, he and J. L. Atwood, executive vice-president of the company, were called into conference with the British Purchasing Committee in New York. The British very frankly said they needed airplanes quickly. They had reacted favorably to the claims of another American manufacturer who already had pursuit planes in production.

"We'd like to have you build that model," the British told Kindelberger. "That'll save a lot of time."

"I can build you a better airplane, and I can get it built fast," he replied.

With some misgivings, the British told Kindelberger to go ahead—and he went.

Kindelberger and Atwood called together the best minds at North American. They conferred with Ray H. Rice, then chief engineer; Edgar Schmued, design engineer; E. J. Horkey, aerodynamicist, and others. The first conferences started April 5, 1940, with Ken Bowen, now assistant factory manager at Dallas, serving as project engineer. Others soon became involved.

Rice ordered a low-drag, high-lift wing. Horkey had what were then considered radical ideas on such an airfoil. He promised a super-performance job and went to work with his assistants.

The prototype was not built from production drawings but design layouts, so fast was the work done. A great to-do was made in the press over the fact that it was ready to fly and awaiting the installation of its 1,150-h.p. Allison engine just 100 days from the time the first design drawing was made. But the building of the prototype, eventually flown by test pilot Vance Breese, was only the beginning of the story.

A month before Breese flew it—he took it aloft for the first time in October, 1940—design for production was started. In September, Bowen, the original project engineer, was assigned the job of production project engineer. He took as his assistant George Gehrkens.

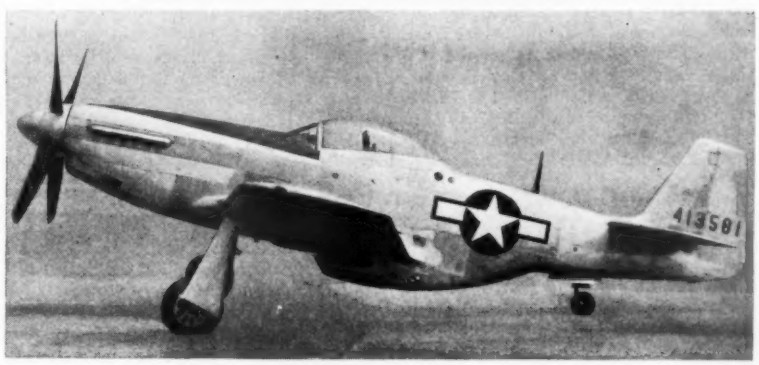
The reasons for the excellent performances which Breese reported became headaches even before he reported them. Building one sleek, trim, super-performance airplane is a hard job. But if, in being built, it contains certain unorthodox designs involving compound curves, flush shin joints for absolute smoothness, and other intricacies, the job of tooling up for thousands of planes fabricated by comparatively unskilled workers becomes a colossal problem. The very wing which was the plane's best asset became the greatest problem of the production engineers.

As no production drawings had been made it became necessary for more than 100 men to devote themselves to this job. Each part had to be considered for redesign or simplification to make it adaptable to mass production methods. Those used in production of the trainers and the *Mitchells* were brought into the picture. In all, 2,990 design drawings were made. Other scores were used in making flight tests and wind tunnel tests.

An example of the type of activity involved is found in Gehrkens' work. His main job was co-ordination of the subassemblies and parts under Bowen, while Art Patch toiled under him on the mass production of the revolutionary wing. In addition he was in charge of cockpit coordination and auxiliary controls. Lieut. Gen. James Doolittle, who is apt to pop up anywhere at any time, tried out the experimental job. Immediately the throttle was moved closer to the pilot's seat to make its operation easier for short arms. Scores of adjustments of this kind caused the British to report later that the plane was "easy to fly."

Flights of the prototype revealed the need for many changes. Wind tunnel tests conducted by Horkey at California Institute of Technology revealed the need for more changes. For instance, flight tests showed that the air scoop intake had to be lowered to increase and alter air flow. Wind tunnel tests revealed the need to raise the carburetor air intake. A combination of tests showed that 50 pounds could be whittled off the flaps without a commensurate loss in aerodynamic efficiency. Wind tunnel tests showed that certain production modifications would not hurt performance. Flight tests dis-

EVOLUTION OF THE MUSTANG



P-51A (and A-36 modification) shown in top photograph was the first production version of Mustang after 320 NA-73's, 300 NA-83's and 150 P-51's were produced for the British. Center photo shows appearance of P-51B and P-51C. These models had four-bladed propellers and air scoop was moved from top to bottom of nose. Lower is P-51D (see gatefold).

This P-51A modification had four cannon.

closed that a change in windshield design was in order.

Work started for the top production engineers at 7:30 a.m. About 15 men met in consultation usually once a day, sometimes oftener, the list including Rice, Schmued, Horkey, Bowen, Gehrkens, Patch, Jack Steppe, who was coming in on fuselage production engineering, British representatives and others. The end of the day's work came at about 10:30 p.m.

"On the night we put the wings on the first production model," Patch recalls, "we were up all night."

The work was all empiric. Everyone was groping into new production fields, meeting problems and licking them. Changes on one unit, because of mistakes originally made, were easy. Changing the production line was many times more serious. Assemblies were broken down into sub-assemblies. These in turn were broken down into parts. And then the work of making the parts was broken down into simple operation to accommodate the lack of skilled help.

"You can correct a mistake in prototype design in a day, maybe," Gehrkens says. "But just try to do it in 20 times that when you're tooled up and on your way."

Nine months after design for production was started the first production airplane rolled off the line.

The X-73 had been built in accordance with United States Army specifications but without Army supervision, as the contract was with the British. The first production NA-73 was delivered to our ally in November, 1941, a month before Pearl Harbor. The fifth and tenth off the production line went to the United States Army for testing and experimentation. In all, 320 planes were delivered to the British, with an order for 300 NA-83's (the plane did not yet have a U. S. Army designation) following.

During the long period of designing for production, changes had been made. Bowen was promoted and Herb Baldwin became production project engineer. On Baldwin's death in July, 1941, Gehrkens had taken over, with Patch working on wing and Steppe on fuselage. Hovering over them and the airplane was Rice.

Then came the reports from Britain of the reconnaissance work, of the performance at Dieppe.

"If we had more power and better supercharging," everybody said, "we'd have the greatest airplane in the world."

The next 150 were known as the P-51's. They were destined for the British under Lend-Lease, but the United States Army, now becoming aware of the late-starting Cinderella, took more than a third of the order. Reports came back from Tunisia and Sicily that the little swifty, still clinging close to the ground, was doing an amazing job of "photo recon" work and that, with four 20-mm. cannon, it was doing a job of ground strafing. The rest, going to Great Britain, were added to the British army co-operation command. British engineers studied the plane and discovered something that amazed them—in spite of the fact that a 20-mm. isn't small and the *Mustang* wing isn't thick, North American engineers, back in Inglewood, Calif., had achieved the seemingly impossible—there were no drag-creating, speed-slowing bumps on the wing—just a couple of holes! They immediately applied the design principles to their own aircraft.

British pilots flying the *Mustangs* began diving on Nazi locomotives and blowing them up. The raid on the Dortmund-Ems Canal resulted in a string of blown-up barges. Flying tree-high, the *Mustangs* became known as "train busters" and "barge blasters."

In Inglewood, the production battle was going even more furiously. In June, 1942,

Wind tunnel model tests new tail fairing.

long before Dieppe and Dortmund, engineering on the now famous A-36, a triple-threat warplane, was begun. This job, equipped with dive brakes, bomb racks and six .50-caliber machine guns, was destined to become a sky scourge. It was a fighter, a ground attack plane and a bomber. It was soon found that the airplane could dive and climb almost vertically. It was powered with the Allison, now rated at 1,350 h.p. The A-36 order, incidentally, was the first to come outright from the United States Army.

The first airplane, without any major design changes except those mentioned above, was tested in September, 1942, and production was completed by March, 1943, in time to contribute to the Axis debacle at Pantelleria. The *Mustangs* photographed the area, dived-bombed, did "pinpoint" work. Two *Mustangs* sent an Italian cruiser to a watery death and another sank an Italian transport which had been one of the world's greatest luxury liners.

Engineers, realizing what more power could do for performance, already were at work on the project. The P-51A came into being, Allison-powered, but after a few score were built—some delivered to the United States and some to the British—the Rolls-Royce *Merlin*, developing 1,650 h.p. and equipped with a two-stage, two-speed supercharger with a critical altitude of better than 30,000 feet, was in production and available to North American. This engine would jump the last hurdle—put the *Mustang* up on top of the world.

The P-51B emerged with the *Merlin* in its nose and a four-bladed instead of a three-bladed propeller. It went into production in the late spring of 1943. By this time, the P-51A had been called "the fastest low-level airplane in the world."

Gehrkens, Patch and Steppe, working under Rice, were still in there pitching. It became legend around the factory that one of the three always could be found on duty. The P-51B carried four .50-caliber machine guns and bomb racks. Dive brakes were eliminated. The radiator installation was redesigned. The plane was strengthened to carry the larger engine. New ailerons gave improved performance. The plane was cleaned up from spinner to rudder.

The new model now in production (P-51D) has a "bubble" canopy which gives the finest visibility to fighter pilots since the days of the open-cockpit biplanes of World War I. Other models, still further improved, are in the design and experimental stage.

The job of building the *Mustang* has proved never-ending, which is true of every airplane now in mass production. Changes are being made daily and there are scores per month—even while the planes flow from the final assembly line. Improved manufacturing methods have resulted in each unit being produced with an outlay of only 3,300 man-hours, a fraction of the number required at the outset.

The first P-51B's were delivered to a combat group early in November. On December 1, just 17 days later, they went out on their first operation over enemy territory. Early in January, the group knocked down 18 German combat planes in one day without a single loss, which was a record. A week later, the group accounted for 15 Nazi craft without loss. But the record which tops all the rest is that they had netted a total of 103 German aircraft shot out of the skies just 83 days after starting operations, beating the *Thunderbolt* record of 100 planes in 88 days.

Today, the P-51B's are doing the longest escort work in the European theater. A series of covers is used for the bombers on their runs from Great Britain over Germany. British planes, with short range, travel the first leg. They drop out, and the *Lightnings* and *Thunderbolts* take over. Finally, the *Mustangs* move in, come over the target ahead of the bombers and meet the Nazi intercepters. The *Mustangs* spend about 45 minutes over the target, clearing the air.

Today, just three years after the first production airplane took to the air, several thousand have been built and more and more are coming off the lines each month. At the same time the airplane gets better every day. END

the Month's Best

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BF W A46-177
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FALLEN FOCKE-WULF

WAITING WARPLANES

"RUN UP NUMBER THREE..."

"SECURE ALL PLANES"

MAILPLANE FROM HOME

DEATH OF THE 'WASP'

DEATH of the 'WASP'

A Navy fighter pilot recounts the Jap torpedo attack on the carrier "Wasp", as viewed by him from the air.

By SPENCER HELD

Staff Writer, San Diego Tribune-Sun

Lieut. Millard ("Redbird") Thrash and his Wildcat at Guadalcanal after Wasp sinking.

"REDBIRD" THRASH was just back from the South Pacific war zone when the author talked with him in San Diego recently. A splendid physical specimen, with his 195 pounds of bone and muscle topped by a fighting chin and a mop of unruly red hair, he could have passed for a college football star at the end of a hard season except for one thing—he was nervous as a cat treed by a hound.

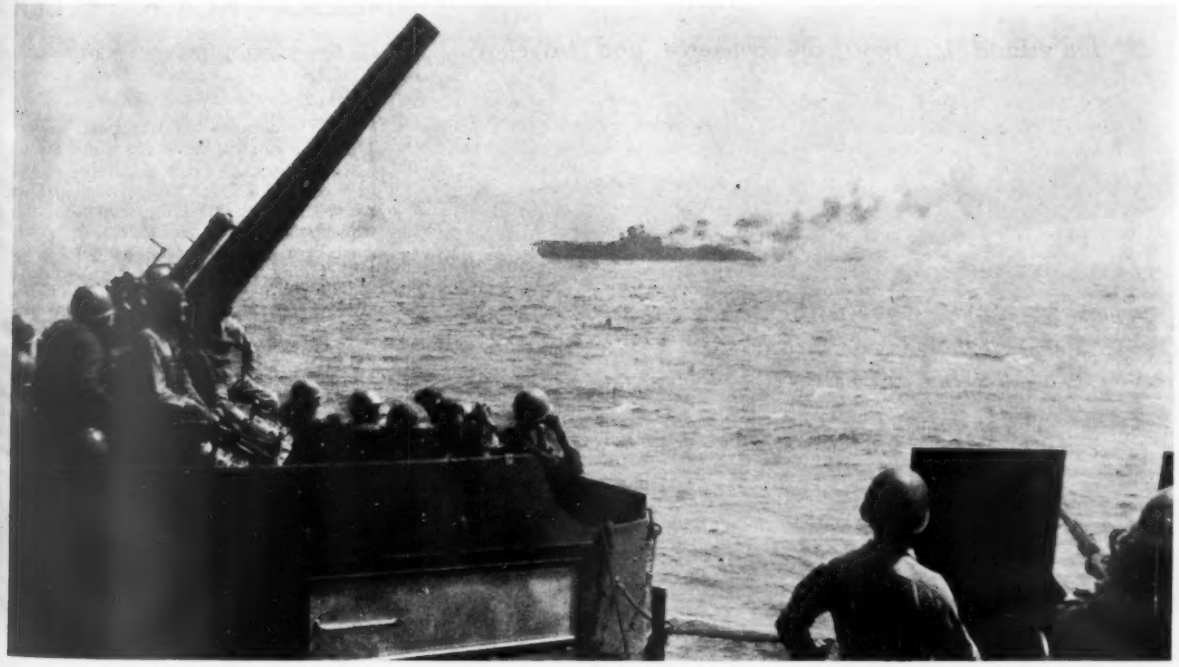
And no wonder. As a Navy fighter pilot, he had survived enough harrowing experiences to turn a man of weaker fiber into a gibbering idiot. He was shot down at Guadalcanal and Munda; poured lead through at least nine Jap planes; bailed out three times at night; lost seven roommates; and watched his torpedoed carrier—the *Wasp*—burn fiercely while hundreds of men went over the side.

Lieut. (jg) Millard Thrash, USNR, (he was nicknamed "Redbird" by E. M. ("Doc") Spaulding, his flight surgeon) is 25 years old and comes from Reedy W. Va. He was a debater and majored in history at West Virginia University; he is quick-witted, articulate, and knows what he is fighting for.

Let him tell the story of the *Wasp*:

"We were called upon to join the American task force which attacked Guadalcanal in the summer of 1942 Fighter planes from the carrier covered the landing of the Marines August 7, strafing the beaches, and my squadron shot down 17 float-Zeros and four-engined flying boats. The *Wasp* then stood by for more than a month to intercept any Jap attacks.

(Continued on page 110)



Doomed Wasp as seen from the decks of an accompanying warship. The carrier was struck by three torpedoes from Jap submarine.

LATIN AMERICA'S AIR FUTURE

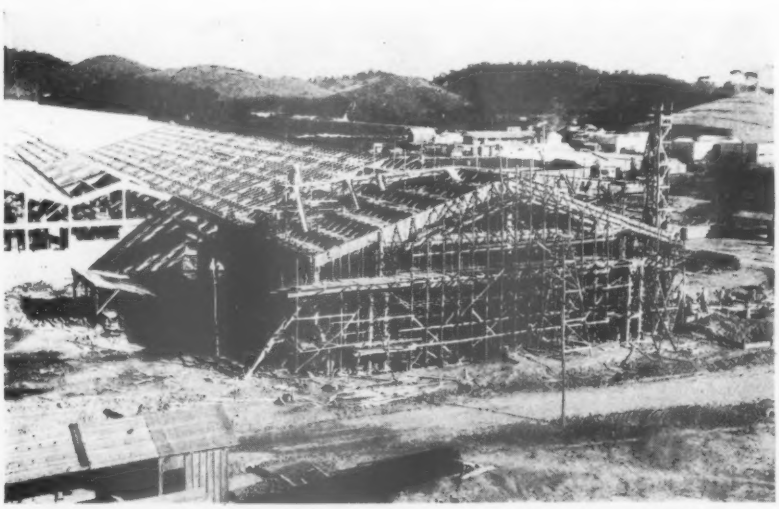
Wartime use of outmoded transports like this old Ford trimotor marks South America as a huge post-war market for air equipment.

Air transports tapping the rich South American war resources are rapidly opening up its virgin hinterland for post-war commerce and travel.

by

NELSON ROCKEFELLER

Co-ordinator of Inter-American Affairs



Evidencing industrial planning for post-war air commerce, Latin American republics are already building aviation plants. This is the National Motor Factory near Rio de Janeiro.

IN TWO decades air transport has become a mighty force for unity among the Americas. From small beginnings in the '20's, a great network of airlines has been built. The importance of this transport system has increased vastly since Pearl Harbor. The airplane has led in bringing the Americas together in a united front against a common enemy.

Air transport has taken up a considerable part of the load of travel formerly handled by ocean-going passenger ships. Most of these vessels have been assigned to war tasks, leaving the airplanes as our main avenue of fast travel to South and Central America and Caribbean republics.

Nowhere in the world has there been such an horizon of promise for commercial air transport as in the Western Hemisphere. In the decade after the first World War, air transport took root in the Americas and has grown with astonishing rapidity. Today it is entering a still greater period of development.

This war is giving the strongest impetus

yet felt to expansion of aircraft production and flying. With mass production comes a new epoch in the airplane's career. Today it is production for war. Tomorrow it will be production for commercial transport.

In two decades more than 100,000 miles of airlines had been mapped out and put into operation in the other American republics—nearly three times the mileage of the United States air transport system.

Upon this foundation there was room for quick expansion to meet the needs of war. Military requirements rule out extensive development of commercial air transport for the time being. Yet air commerce continues to make progress.

Since the war began, the American republics have undergone rapid airport expansion. In the 20 Latin American republics, at the close of 1944, there will probably be more than 2,100 civil airports, of which 300 to 400 will be Class III or better.

The airplane is taking on new tasks apart from its primary war role. Travel by air, north and southbound, has increased several fold. Cargo planes bring in lightweight strategic materials, such as quartz crystals from Brazil. Southbound air cargo carriers rush urgent supplies, such as medicines for workers on rubber projects in the Amazon. The airplane opens the way for exploration and transport in remote areas.

These war tasks again show how well the airplane is adapted to the Western Hemisphere. From the Rio Grande south to Cape Horn is a 7,000 mile stretch of some of the most varied and rugged territory on earth. South America alone is two and one-third times the area of continental United States. Down through Mexico and Central America and the west side of South America run mountain ranges rising to peaks of 23,000 feet. These mountains have discouraged transcontinental rail arteries in the other Americas. Modern rail and highway arteries have been similarly discouraged in the huge Amazon Basin.

The Amazon is tropical country. It is this tropical region, along with tropical areas of the Caribbean, that we have learned to count on chiefly for supplies to replace tropical imports we lost in the Netherlands East Indies, Malaya, the Philippines. Spurred by war, air transport is playing a big part in hastening this development.

The Interdepartmental Air Cargo Priorities Committee, War Production Board, states that in 1943 total movement of imported materials by air was 42,010,298 pounds, amounting to $119,890,402 in dollar value, of which 5,429,522 pounds, with a dollar value of $25,617,865, were flown to the United States from 20 American republics including the Canal Zone. Most of these air shipments from Latin America consisted of vital war materials such as Brazilian quartz, mica, tantalite, beryllium, and crude rubber.

Long before the war, air transport possibilities of the Americas had been recognized by pioneers, many of them potential enemies. German and Austrian pilots, veterans of the First World War, founded in 1919-20 the first permanent air transport line in the Western Hemisphere. This was Sociedad Colombo-Alemana de Transportes Aereos, called Scadta.

Shipment of silver ingots goes on board a Lockheed Lodestar for transportation to the United States. In 1941 TACA carried more cargo than all U. S. domestic airlines combined.

When American-controlled lines later entered the field, German controlled lines were well entrenched. Airlines under German and Italian control or domination expanded to more than 20,000 miles over scheduled routes, threatening the security of the Americas. In Brazil, Colombia, Bolivia and elsewhere the Germans and Italians covered strategic points of Western Hemisphere defense. Some lines lay within easy distance of the Panama Canal.

With the war in Europe, the alarm of the Americas over Axis-controlled airlines increased. The situation demanded co-operative action to eliminate the threats to hemisphere security. One by one, Axis-dominated lines were taken over by the other Americas, transferred to new ownership or prevented from operating. The work was completed with the elimination of German control of the big Brazilian line, Syndicato Condor.

Today, Brazil, Argentina, Mexico and other countries to the south have become increasingly air-minded. They have taken a more active hand in control and development of their own airlines, linking these with the international routes.

The Air Transport Command, with its airlines to the battlefronts overseas, has carried the Air Age into one of its spectacular advances. Bound for the world fighting fronts, the ATC fleets have multiplied air traffic throughout the world.

In commercial air transport, progress has been limited by shortage of equipment, skilled personnel, landing facilities. These difficulties have now been partly overcome as new air bases spring up and more and more air crews are trained. While less spectacular than ferry routes overseas to the fighting fronts, inter-American air routes are a strategic part of the growing world web of airlines for wartime transport.

Beyond the war, one may envisage another—and greater—period of commercial air development in the Western Hemisphere. As after the First World War, South America will hold new allure. It will offer an outlet for expanded aircraft productive capacity, for the talents of skilled flyers. Interest in flying in the other Americas, both by individuals and private and Government organizations, has increased. This interest will continue to grow. Airports and air routes developed in wartime may be joined with expanded manufacturing capacity and flying personnel in post-war commercial aviation.

By nature the other Americas are peculiarly fitted for the air age. The terrain makes aerial travel for both passengers and freight highly practical.

Unlike the United States, the other Americas have not invested great sums in grand-scale highway and rail systems. The heavy dependence of the other Americas on air transport, rather than railroads or highways, in the interior makes air developments unusually important to them.

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Education for the Air Age

Educators at Stanford University discuss changes in geography curriculums which aviation is bringing about in the schools.

By ALBERT BARTLETT

School courses are being reorganized as educators start integrating aviation subjects into all parts of curriculum from first grade on.

OUR educational system is launching a revolutionary job for aviation. Basic courses in the science of aeronautics, thanks to the initiative of the Civil Aeronautics Administration, are now being offered in more than half of the 28,000 high schools of the country. This means, roughly, that during the past year approximately half a million youngsters have studied at least one aspect of aviation. Next school year the number of schools and students will appreciably increase.

The courses taught, it should be emphasized, are not parts of a vocational training program. They are not primarily designed to turn out pilots, aeronautical engineers, or other aviation specialists though undoubtedly many more young people will be inspired to look in that direction when choosing a career.

Rather, they are offered as cultural subjects in the broadest sense of that term. They are designed to enable students to orient themselves more readily and intelligently to the kind of world in which they will live. We do not teach chemistry primarily for the purpose of producing professional chemists. We teach it because we believe that every child should be familiar with its principles and its influence upon modern life. And so it should be with aviation.

Here at last is a healthy grass-roots program to spread the gospel of aviation abroad—a program with roots in every community, large and small, reaching from the school into almost every home in the land—a program developing from below and not superimposed from on top.

The program stems from the Civilian Pilot Training Program, initiated on an experimental basis early in 1939. Within little more than a year the program had been adopted by some 700 colleges from coast to coast. For the first time flying instruction was simplified and standardized. Ground school work was sharpened and refined. More than 1,000,000 textbooks had been printed and sold.

By Pearl Harbor, thanks largely to CPT, there were more than 100,000 licensed civilian pilots in the country—a four-fold increase within less than three years—a huge reservoir of trained airmen from which the Army and Navy drew many of their best pilots, including Maj. Dick Bong, Maj. Walker Mahurin, and Maj. Joe Foss, to name a few.

With the outbreak of war, the CPT became the War Training Service which was not however and did not pretend to be a broad educational program aimed at the general public, as the CPT had been. Failure to recognize this cardinal fact has led to proposals that post-war aviation education of American youth should be placed wholly upon an ROTC basis, which is to put the cart before the horse.

The training of an adequate number of potential military pilots will be a natural end-product but only one of many invaluable end-products of a sound and democratically-conceived aviation education program reaching all the youth in the land.

The base of such a program has already been laid and is constantly being strengthened, thanks again to the Civil Aeronautics Administration under the creative and far-sighted leadership of the Administrator of Civil Aeronautics, Charles I. Stanton. It is a natural and logical extension of the original Civilian Pilot Training Program.

From the first it was realized by those who initiated the program that CPT was, in a sense, launched "wrong end to." The place to start a broad and comprehensive program of aviation education, wartime

emergencies aside, is not at the top, in the colleges, but down below in the secondary and even the primary schools.

As soon as CPT was well under way, steps were taken to do just that. Before Pearl Harbor the CAA called in prominent educators, aeronautical experts, and scientists of all kinds to discuss possibilities. With the co-operation of the U. S. Office of Education, the Army, and the Navy, a National Joint Advisory Committee was set up to outline procedures and get such a basic program under way in all 48 states.

Finding a great want of appropriate textbooks and laboratory manuals, the CAA gave technical assistance in preparing up-to-the-minute teaching materials. These dealt with all aspects of the Air Age—not only with the principles of aeronautics, but with the influence of the airplane in relation to the study of the social sciences, geography, biology, mathematics, literature, industrial arts, even the fine arts. The aim, in short, was to integrate appropriate aviation material into all parts of the curriculum from the first grade through senior high school.

In addition, a specific course in the science of aeronautics was designed for use in the upper grades of senior high schools. This course covered everything from the principles of flight through airways communications to weather study and navigation. The theoretical knowledge in this course is equivalent to the ground-school work required to obtain a private pilot's license. More than 23,000 students in these aeronautics courses passed the official CAA examination in 1943 and thousands more will take the examination in 1944.

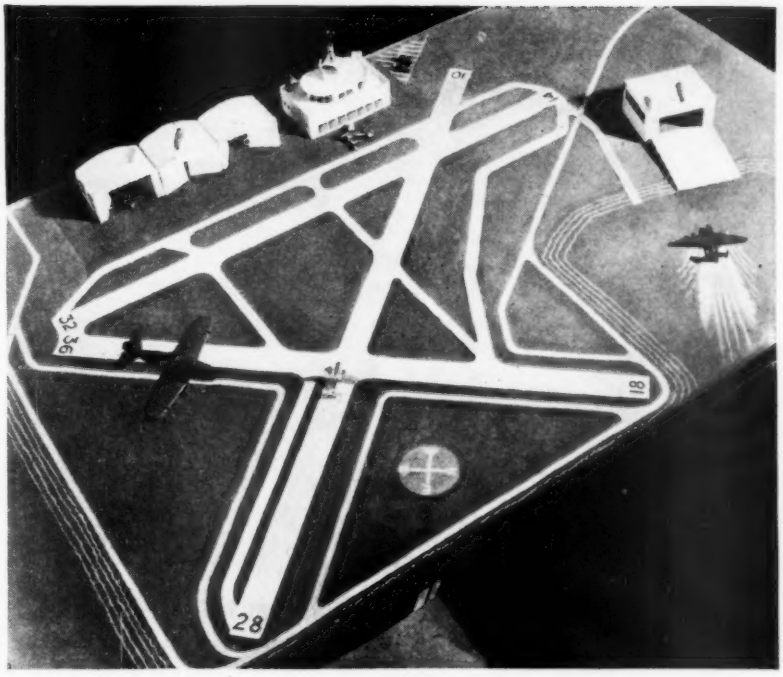
Aware of another need, the Civil Aeronautics Administration also opened its facilities for training teachers. In the summer of 1942 some 2,500 of them were invited to take CPT ground-school courses. In the spring of 1943—double that number received such instruction under the auspices of CAA in 135 teacher training institutions throughout the country. More recently, operations institutes have been held in 17 cities to familiarize teachers with the operation of the 35,000-mile Federal Airways System.

Put into operation in September, 1942, this aviation education program is not quite two years old—a short time, to be sure, yet long enough to prove quite clearly that here is one of the most significant and promising developments of years.

During the 1943-44 school year, according to Bruce Uthus, Director of the CAA Aviation Education Service, 204 of the 259 public senior high schools in Massachusetts offered courses in the science of aeronautics. "The private school figures are comparable," reads a recent field report from that state. "A few schools dropped the course during the year. But as 29 schools adopted it for the first time, this resulted in a small net gain over 1942-43."

In Connecticut, 70 of the 99 public senior high schools now offer "regular year-length courses in aeronautics," representing a steady and encouraging in-

(*Continued on page 92*)



Some phase of aviation education is applicable to virtually every subject taught in the schools. In this case, table model of San Francisco airport was made by an art teacher. Other projects show the growing influence of aviation on practically all of the fine arts.

Scene in the CAA Project Laboratory, Stanford University, which has been active in the plan to integrate various phases of aviation education into public school curriculums. Courses devised here approximate ground school work required for a private pilot's license.

World Routes

Having tentatively mapped the world air routes, the Civil Aeronautics Board is now in the midst of pre-hearing conferences and has scheduled tentative hearing dates for airline applications. The world map has been divided into five areas for route applications—North and South Atlantic, North and Central Pacific, and Australia. More than 100 applications have already been received by the Board . . . Among those filing for foreign routes are American, American Export, Braniff, Northeastern, TWA, and PCA in the North Atlantic; American Export in the South Atlantic; Chicago and Southern, Northwest and TWA in the North Pacific, and Northwest, Western, United, and the Ryan School of Aeronautics in the Central Pacific . . . The flood of foreign route applications adds an additional load to the already overloaded Board hearing schedule, which includes more than 600 domestic applications still undecided.

Pan Am Mystery

Significant is the fact that no application for a foreign route has been filed to date by Pan American, whose Juan Trippe has been the chief proponent of a so-called "chosen instrument"—one line to represent all U. S. interests in postwar foreign air transport. Also missing from the applicants is United, another proponent of the one-line idea. Speculation here is that both companies will file for franchises before the hearings get underway in mid-October, but this probably is not the case . . . Little-known fact is that Pan American has already filed as interventor. This means that its representatives will be able to appear at Board hearings on foreign applications and protest granting of franchises. Protests will probably be backed by two contentions—that the applicant will damage established Pan American interests and that competition of U. S. lines on any given foreign line will be damaging to over-all U. S. interests because of airline monopolies of other governments. In other words, the chosen instrument arguments seem destined to get into the Board hearings, if only by the back door . . . Reactions to the Board's world airway plan, incidentally, are conflicting. The flood of applications which followed the announcement would seem to indicate that most airlines welcome anything definite and are willing to play along. But Beaverbrook-controlled editorials in England criticized the plan severely for being premature and too ambitious; and chosen instrument advocates have condemned it with silence . . . Any way you look at the international transport situation, it will be good for plenty of fireworks, oratorical and otherwise, during the coming fall and winter . . .

On the Hill

Sen. Champ Clark's committee on foreign affairs is rumbling protest under its collective breath at the Board's world airway plan and a statement condemning the Board action may be expected . . . Whether this will be tied into the political campaign is a moot question, but it might well be . . . Politics have pushed aviation interests somewhat into the background elsewhere on the Hill, although a fight is brewing on the postwar airport program. Public Roads already has a bill proposing that it go into the flight-strip business in a big way, subject to approval of the Civil Aeronautics Administration . . . What might be considered a re-write of the Public Roads proposal, giving all airport activities to CAA, has been introduced by Congressman Jennings Randolph of West Virginia, and it may be anticipated that the two philosophies represented will clash before any legislation is passed . . . Public Roads' proposal favors tieing strips and even airports onto the Federal roads appropriation, while the Randolph idea would be to keep the two separate and delegate all airport problems to men qualified to know the present and future needs of airmen . . .

Grass Whopper

Being of the lawn-mower, or tired householder, specie of grass expert, we read with interest recently of a wonder grass named Zoysia developed by the Civil Aeronautics Administration that could lick the pants off of crab grass, not to mention the Japanese beetle, but which still never grew so long that you had to bother to cut it. Indeed—said the story—the CAA grass had been cut only once in five years. It was also tough enough to withstand the impact of landing airplanes, stayed a brilliant green throughout the summer, was a fetching brown in the fall and winter and would, in sum, do everything but grow on a bald man's head and milk the cow as well as feed him . . . We almost sold our lawnmower before investigating further, but fortunately didn't, it developing that the grass in question, for all its sterling qualities, is a sucker for a knockout punch from the old-fashioned, garden-variety American weed. Besides, it isn't as tough in other respects as first reported . . . Seems a press agent let his imagination run away with him, much to the embarrassment of one Joseph Yarrow, turf engineer for the airport division of CAA, who has been living with Zoysia and several other varieties of grass for five years. Mr. Yarrow says he'd *like* to discover a tough, non-growing grass, but can't report anything startling at this time . . .

The British Say . . .

During the first AAF shuttle bombing flight of U. S. *Fortresses* from Italy to Russia, the Germans sent up a captured *Fortress* to join the U. S. formation. It was unnoticed for some time but the U. S. aircrews soon became suspicious, finally identified it as being manned by an enemy crew and destroyed it . . . Along the same lines, the A. P. reported from Valencia, Spain, in July, that nine Germans had made a forced landing in a *Fortress* and been interned there. The plane bore German markings and apparently had been patched together from various Allied planes which had crashed in German territory . . . The British also say that Lockheed *Lightnings* are being used with up to 2,000 pounds of bombs in precision bombing of German targets behind the lines in France from altitudes of 20,000 feet . . .

Pro-Pilot

It's seldom in these days of total war that you hear anybody coming to the defense of the private pilot, and the last place you'd expect to hear it would be before the Senate's Committee on Military Affairs. But that is exactly what Joseph T. Geuting of the General Aircraft Corporation did recently—and an excellent presentation he made while he was at it. As chairman of the Personal Aircraft Council of the Aeronautical Chamber of Commerce, he said, among other things: "Regulation of personal aircraft and the personal pilot has grown through the years to the point where present regulations impose onerous burdens which ham-

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Photo of DC-3 shows location and color of position lights. Colors and flashing periods were worked out after numerous experiments.

TRANSPORT BLINKERS

By ALAN L. MORSE

Chief, Technical Development Division, CAA

The author

Near crackups caused by difficulties of night visibility inspired research program on aircraft position lights.

A TRANSPORT pilot, seeing another plane headed toward him from five miles away, has exactly 30 seconds before the planes pass, if both planes are traveling at 300 m.p.h. At night this time may be cut in half or less if lighting on the planes is inadequate to provide a five-mile visibility.

This situation was the underlying thought at a meeting in July, 1941, attended by aviation experts, lighting experts and members of the Technical Development Division of the Civil Aeronautics Administration. As a result of that meeting the CAA inaugurated a program to develop aircraft position lights that would improve the safety of night flying.

This project started, not as a result of a bad accident, but from the contemplation of dangers to be avoided. The development thus far (it is not yet complete) is gratifying to airline pilots, the men most directly concerned with adequate lighting of transport planes. The CAA is pleased with the progress to date, because the problem is a great deal more complex than appears on the surface.

There had been a number of near accidents in the air and several minor accidents in which transport planes had run together on the ground. At Wichita, Kan., two airliners came together as one was taking off. The pilot of the plane taking off mistook the tail light of the plane on the ground for a temporary boundary light. In another instance (on May 9, 1941) an Eastern Air Lines plane reported to the Washington, D. C., range station that it had almost collided with an Army bomber which did not have its position lights turned on. The Army pilot also reported the near collision, but proved that his lights *were* on. Both pilots were much concerned about the near collision.

The meeting, called by the Safety Bureau of the Civil Aeronautics Board, was attended by airline pilot representatives. Air Transport Association officials, representatives of the National Bureau of Standards, the Army and Navy departments, the CAA, American Airlines and United Air Lines. The problem faced was, first, the development of an improved tail light of suitable brilliance and conspicuousness; second, development of an auxiliary forward position light particularly for transport planes; and third, a long-range program covering position lights generally.

Specialists in aircraft lighting participated in this work. Frank Breckinridge, of the National Bureau of Standards, conducted numerous observation and photometric tests for the CAA. Harry S. Purnell, with more than 15 years of experience in lighting problems within the avia-

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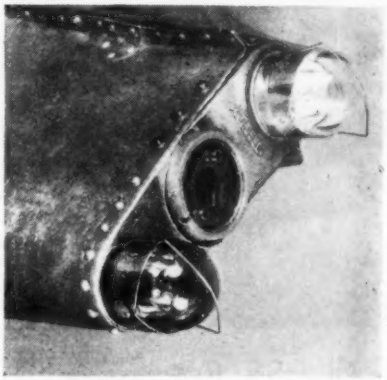

Flashing periods of red and white tail lights are timed to prevent "blending."

DISPOSING OF SURPLUS WARPLANES

By JOSEPH A. BORS
Washington War News Editor, International News Service

Aimed at keeping U. S. aviation strong, Harvard report recommends plan to dispose of five classes of surplus planes and equipment.

CLASS A
(COMBAT PLANES)

Thunderbolts, above, are examples of the largest group of surplus aviation equipment which must be disposed of. Class A includes fighters, bombers and other tactical aircraft not economically suitable for commercial purposes. Some may have to be junked.

CLASS B
(TRANSPORTS)

Primarily useful for scheduled transport duty, these C-47's fall into Class C. Types vary from 7,500-pound Beech Voyagers to the largest four-engined transports in use when the war ends. Despite large production, attrition rate in wartime is severe.

A BLUEPRINT designed to assure America's continued supremacy in military and commercial aviation has just been submitted to Congress in the form of an exhaustive report by Harvard University's Graduate School of Business Administration, which recommends early disposal of surplus fighting planes and transports being accumulated by the U.S. Army Air Forces.

Chairman James E. Murray of the Senate War Contracts Subcommitteee describes the study as one of "comprehensive and far-seeing character." Its three main recommendations are:

1. To provide transport planes for commercial airlines in the United States as soon as possible.

2. To provide "friendly" neutral nations with both combat and commercial-type planes under a plan designed to create a post-war world market for American aircraft.

3. To equip schools and other educational institutions at home with planes and equipment for training aviation-minded youngsters.

At the request of the Army Air Forces, Harvard experts spent six months preparing the report. It was then submitted by Murray to Chairman Robert H. Reynolds of the Senate Military Affairs Committee. Murray emphasized, however, that the study does not necessarily reflect the views of the subcommittee or the War Department, but praised it highly.

The report points out that when the war is over the surplus aeronautical equipment owned by the Air Forces will run into billions of dollars. It suggests that machinery be set up immediately to begin disposal of older types of planes even before the end of the conflict.

The Harvard experts take sharp issue with proponents of the philosophy that surplus war materials are a drug on the market and should be scrapped. In commenting on such suggestions, the Harvard report states:

"It is nearly a certainty that this extreme position favoring immediate scrapping of all surplus planes and components would not be acceptable to public opinion in the United States. Any argument which favors the building of a new DC-3 or an 1830 engine exactly similar to a DC-3 or engine which has just been destroyed is almost certain to be rejected by the American people."

First, the Harvard group recommends that while the war still is at fever-pitch specific preparatory steps should be taken to arrange methods of surveying the condition of planes, permit manufacturers to do engineering work in preparation for modifying models known to be commercially usable, and have the Civil Aeronautics Board test and license commercially usable types.

Secondly, it recommends that a central Government disposal agency be created, including representatives of the State Department, War and Navy departments, the Civil Aeronautics Authority and the Treasury, but that actual handling of the various planes be turned over to the original manufacturers to insure that they are in the best possible shape.

To facilitate handling of various types of planes and equipment, the report sets up five categories from A to E, as follows:

CLASS A: Fighters, two and four-engine bombers and other tactical aircraft not economically adaptable for commercial flight purposes. This is the largest group.

According to the report, the only outside market for most of the Class A types is the air forces of friendly foreign powers. Any oversupply in this category should be transferred to Class E, to be used for educational and other ground purposes or to be stripped of components for salvage..

CLASS B: All planes primarily useful for scheduled transport operations. These range in size from the 7,500-pound gross weight of the Beech *Voyager* to the 75,000-pound and higher gross weight of large four-engine transports.

CLASS C
(CIVIL FLYING)

Smaller liaison-type planes will be listed in Class C. They may be used for business purposes, commercial activities such as crop dusting, and flight training or personal flying. The DPC is already disposing of some of these planes used by War Training Service.

"The excess supply of surplus transport planes may, after post-war demands are met, be far less than the many thousands now generally anticipated," the report states. "The attrition rate in wartime military operations is understandably severe. Moreover, many of those remaining will be in such conditions as scarcely to warrant rebuilding for commercial use.

"Even so, the supply of the more numerous types (e.g., Douglas *Skytrain* and Curtiss *Commando* will probably be

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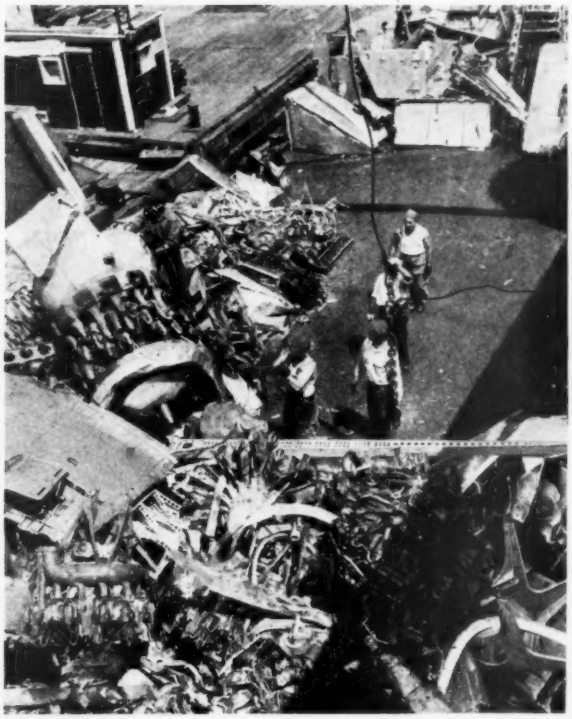
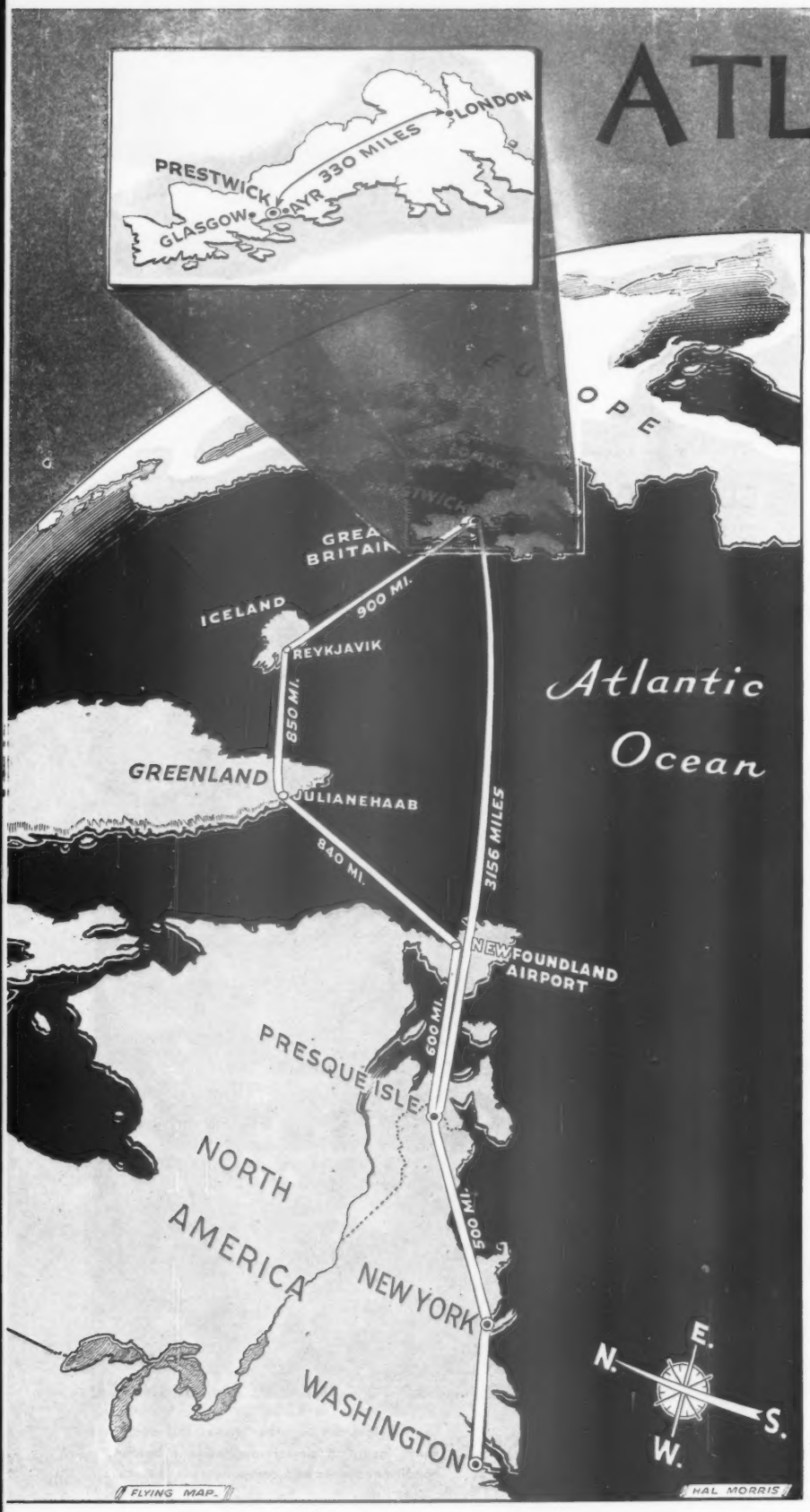
CLASS D
(COMPONENTS)

Major components include engines, propellers, instruments and radio equipment, but exclude combat material such as bomb sights and guns. Smaller components are included in Class E.



CLASS E
(SALVAGE)

Class E includes all other planes and components, including aircraft and parts in unsound condition. Planes and components in the other classes may later be placed in this class.



THE whimsical hand of war, which obliterates cities centuries old and builds towns where once there was only desert or forest, pointed a finger at rural Prestwick, Scotland, and made it a focal point in the world-wide air transport system of the United Nations. The town that formerly entertained Scottish workers on their holidays now takes in its stride visits by kings and prime ministers, admirals and generals, ambassadors and diplomats, and thousands of boys going to, or coming from, the war.

Prestwick airdrome is to the world airways what Chicago is to the United States commercial air network. It is a junction point for routes reaching south to Africa, north to Iceland, and west to America, and for routes throughout the British Isles. It is a calling point for scores of ferried planes and transports every week. And on any day you can pick out men wearing the uniforms of all the major Allied forces, representative of all the occupied countries of Europe.

Prestwick is not on ordinary maps. Its population in 1931 was 8,538 and the area of this Ayrshire community is listed as 1,040 acres. If you wish to find it, locate Glasgow in southern Scotland, then look south until you find Kilmarnock, only 10 miles north of Prestwick. If the map is sufficiently detailed it will show Ayr, a small port and residential city, south of Kilmarnock on Scotland's west coast. Put a pin between Ayr and Kilmarnock and you'll have the approximate location of Prestwick. And put a small American flag on the end of your marker because that pinpoint is important to you.

Rambling over several hundred acres of rolling farmland, Prestwick airfield is quite unlike most military airports. It encompasses several buildings operated by Scottish Aviation, Ltd., as well as American and British hangars, officers' clubs for both services, and barracks areas. Its principal runway extends 6,600 feet, and the cross runway is sufficiently long to accommodate the fastest fighters and the heaviest bombers and transports. All runways, perimeter tracks and taxiways and most of the parking areas are of concrete.

Transatlantic air routes created since war converge on Prestwick's fog-free runways.

CROSSROAD

By
E. JAY DOHERTY
Formerly TWA Station Manager, Prestwick, Scotland

War chose Prestwick, Scotland, as great transatlantic plane terminal. Its excellent flying weather may keep it important.

Its hangars, huts and administration buildings are spread over a wide area, partially to minimize damage from potential bombings and partially because it has grown piecemeal to keep pace with the booming deliveries of battle planes and mushrooming air transport services. While the field is officially controlled by the Royal Air Force, the U. S. Army Air Forces Air Transport Command has an organization working independently of the RAF

Two principal functions underline the importance of Prestwick in the Allied scheme of war. It serves as a transatlantic terminal for American and British air transport services from the United States and Canada. Hundreds of heavy and medium bombers and pursuit planes have been delivered here within the past three years. From Prestwick they are taken to operational bases as needed by pilots of ferrying squadrons attached to the Air Forces in Britain.

However, its growing fame among Americans stems from its function as a port of air embarkation and arrival for the British Isles. Americans scurrying across the ocean on business important to the war are familiar with Prestwick. Every day Douglas transports pull in front of the administration building to disgorge passengers as casually as the airlines do at LaGuardia Field. They reload within a few hours and are again on their way to New York or Washington to pick up high priority passengers or cargo bound for the European Theater of Operations.

This is a major terminus of the far-flung transportation division of the Air Transport Command. The huge *Skymasters*, which can carry up to 26 passengers or four tons of freight on ocean hops, are operated by TWA and American Airlines under contract with the Army Air Forces. Their ocean crossing is carried out with the precision of a domestic airline—but with somewhat less adherence to scheduled times—a grudging concession to Old Man Weather, who makes the North Atlantic one of his main stamping grounds.

Surprisingly, because the North Atlantic has always been considered one of the most treacherous areas for flying, the number of weather cancellations has been negligible. This is largely due to good weather-reporting services and excellent radio aids to navigation which are in use.

Street scene in Prestwick, showing St. Nicholas Hotel, former stopover point for U. S. contract aircrews on transatlantic flights. Many American ground crew members are still billeted here.

The administration building, which was a small hotel before there was an airdrome at Prestwick, is now an RAF officers' mess, serving as combination office building, flying control center, terminal building and hotel. So many additions have been made to the original structure that a series of wings now wanders self-consciously in several directions. It has been temporary headquarters, probably, to more world-renowned figures than any similar place in the world. Its chief receptionist, Miss Chris Gray, has been decorated by the King with the British Empire Medal for her distinguished handling of important Allied military and diplomatic personages.

Known as the Orangefield, because William of Orange once spent a night in the vicinity, the Terminal Mess is a truly international stopover point. The lobby is decorated with original paintings by Tom Gilfillan depicting the impact of air transportation on different areas of the globe. The Scottish girls at the reception desk have frequently to cope with money from eight different countries and one could speak any continental language and find friends to keep him company.

Because crew members are given priority on transient rooms, flyers from almost every country form the greater part of the clientele. Their aviation conversation roams the world at will without any ostentation. Like sailors, they are apt to have address books containing names of friends in New York, Stockholm, Karachi, Natal, Melbourne, London, Kunming and Casablanca. Their Short-Snorter bills, with signatures reading like pages from Who's Who, are sometimes 10 yards long.

While the aircraft operations are handled by the AAF, the RAF, TWA, American Airlines, BOAC and ATA, the airdrome itself, the administration buildings and most of the facilities are manned and controlled by Scottish Aviation, Ltd., under contract with the Air Ministry. This company performs all maintenance for the British services and their assignment is a natural outgrowth of their ownership

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HOMING BY RADIO

by Sebastian B. Littauer, Ch.E., M.A., D.Sc.
Radio Division, Bendix Aviation Corporation

The Superfortress carries its radio compass atop its fuselage rather than underneath. Cutaway photo of Bendix compass inset above.

THE bombs had been dropped, visibility was good and the Axis was three ships and one fighter plane less. Then the fog and clouds over the Mediterranean between Crete and Bengasi thickened. The triumphant *Fortress* was suddenly lost in the overcast.

The radio operator strained to pick up the signal of a friendly station or of any known station on which a bearing might be taken. Only noise or garbled Axis communications came through.

The pilot lifted the *Fortress* higher for a look at the stars but the soup seemed to extend to the top of the sky. There was no visibility at the plane's ceiling. Off its course, with no means of navigating to its home base, a forced landing seemed inevitable. That meant an even chance of landing in enemy territory.

As the *Fortress* began to descend through the black masses of cloud and fog, the radio operator exclaimed with excitement, "Hold it! Base is coming through"

No one else spoke but those near enough fixed their eyes upon the dial of the automatic radio compass as the needle swung slowly through an arc, halted, pulsed erratically with a crash of static, and then settled down to a steady position.

The *Fortress* swung about until the plane was aligned with the needle. Blind, through fog and clouds, it rode the radio wave home.

Safe at their base, with bomb bays empty, the crew jumped to the ground and their completed mission seemed far away. But under the streamlined nose was the tear-drop shaped housing which protects the loop that is the heart of the Bendix automatic radio compass. Without its guiding radio compass, the *Fortress* would never have returned to fly again against the enemy's strategic targets.

The radio compass is to the airman what the magnetic compass has been for centuries to the mariner. But it is really more. The mariner's compass gave him only the cardinal directions. The automatic radio compass gives the airman the direction of his home base and points the way there.

The discovery of the compass properties of the magnetic needle is an event lost in the maze of history distorted by fiction, but since about the 12th century, far-reaching sea voyages have been made through navigating by the magnetic compass.

Diaz in 1486 navigated around the Cape of Good Hope with the aid of a magnetic compass. Columbus used a single needle-shaped magnet, supporting a paper compass rose mounted on a steel point. Long distance marine navigation was made possible by the magnetic compass more than by any other single instrument outside of ships themselves.

Adaptation of the compass to air flight was an obvious step, but something more was needed in a plane off course and lost in fog with neither Earth nor stars visible. Knowing merely the direction of north or south is of little help in such circumstances.

Radio compass navigation by no means replaces the regular dead reckoning and celestial navigation adapted from the mariner for the airman. But in circumstances where the conventional methods are insufficient, which happen frequently under modern flying conditions, the automatic radio compass is irreplaceable.

To understand where the usefulness of the radio compass supplements that of the magnetic compass, let us refer to the diagrams.

Figure 1 is a diagram of the earth, on which three airplanes are located. In each airplane is a modern magnetic compass provided with a dial and rotating

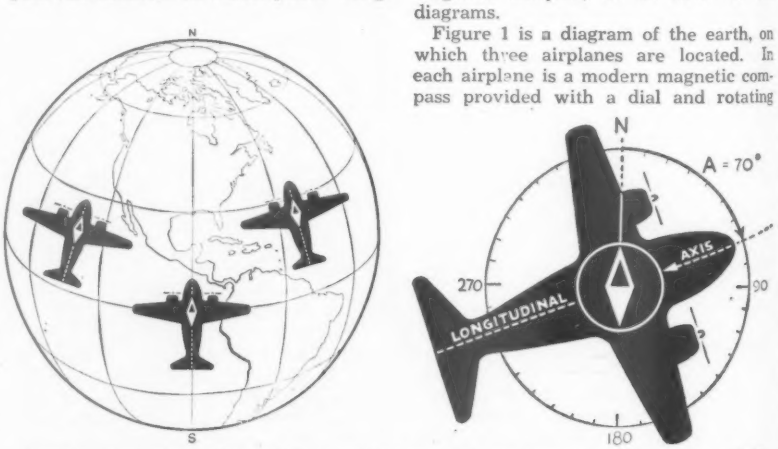


Figure 1. Each plane is headed true north but to a different destination. Diagram on right explains "heading"—the angle between north and direction of plane's longitudinal axis.

pointer for indicating the plane's heading, that is, the position of the pointer indicates the angle between true north and the direction of the plane's longitudinal axis. Ordinarily, the compass needle points towards the Magnetic North Pole, whose direction from an observer is in most cases displaced a number of degrees from the direction of the Geographic North Pole.

In the modern compass it is possible to correct the position of the pointer to account for the angle at the point of observation between magnetic north and true north. It is also possible to correct the pointer position for local magnetic influences in the plane. The corrected position of the pointer then designates the true heading of the plane. For purposes of simplification, therefore, in Figures 1, 2, 4 and 7 the compass needle is represented as indicating true north. Referring to Figure 1, all three planes are headed true north, although they have three different destinations unless perhaps they are on a polar flight.

Now consider a small portion of the earth as shown in Figure 2. Here is a navigation chart on which the location of La Guardia Field is indicated. Again, three planes are shown flying in the same

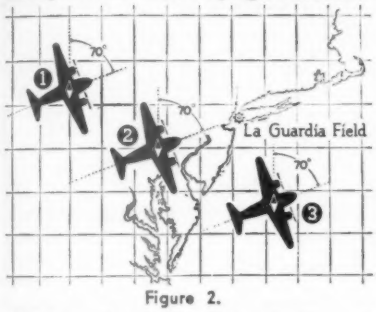


Figure 2.

direction. But notice that only Plane 2 will reach La Guardia Field. In each plane the magnetic needle points north while the longitudinal axis makes an angle 70° with the meridian.

The magnetic compass tells the pilot the angle between his line of direction and the meridian, but it does not tell him where he is going. It indicates a direction but not a destination. For when the magnetic compass discloses the plane's direction it merely discloses one of an infinite number of parallel directions. Unless the pilot can see the earth so that he knows where he is at the moment, he cannot tell where he is going.

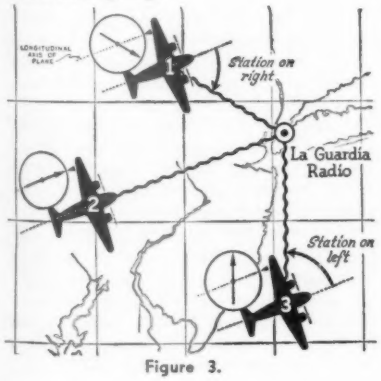


Figure 3.

The radio compass, on the other hand, is both direction and destination finder. This is how it works: Suppose the air is still but visibility is poor and there is an overcast sky so that the pilot does not know his position. His plane, however, is equipped with a Bendix automatic radio compass. Note the radio station at La Guardia Field shown in Figure 3.

The pilot tunes in his radio compass on that station. Then inside the "bomb that is never dropped", the little loop turns and faces the radio station. On the control panel, visible to the pilot, there is a little dial with a pointer that turns with the loop and stops when the loop stops. The pilot turns his plane until the pointer rests on zero. Then he knows that his plane is pointed toward the radio station which has become a pole—not the far-away North Pole, but a pole at his place of destination. His radio compass has picked a direction—not one of an infinite number of parallel directions, but the particular direction to his desired destination. It is, in truth, an automatic direction finder and this designation, "ADF," will be used throughout this article. By so heading the plane that the ADF pointer stays on zero, the pilot "homes" into La Guardia Field.

When the pilot of Plane 1 (Figure 3) tunes in on the same station, his pointer will indicate to the right of zero because the radio station is located to the right of the longitudinal axis of his plane. So he turns his plane to the right until his ADF pointer rests on zero. Then he, too, can home into La Guardia Field. In this simple manner our fighting planes home into their bases with the aid of the ADF after completing their missions.

The station at La Guardia is an aircraft radio range station. Is it necessary to tune in on this station? Not at all. Near this field there are dozens of broadcast stations. The ADF can be tuned in on any of these stations and the plane home

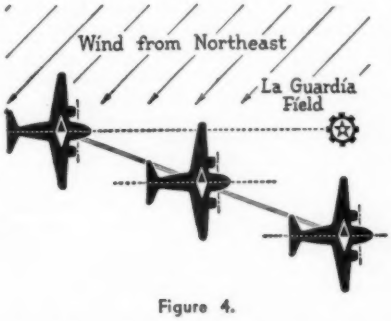


Figure 4.

in on the one selected. In combat zones there are no established airways with radio ranges. But wherever our air forces are based, fixed or mobile radio transmitters are set up for the express purpose of bringing our aircraft back.

You may be wondering what happens when there is a strong wind blowing. Figure 4 shows a plane heading east with a northeast wind to combat. The dashed lines indicate the easterly direction of the plane, but the wind keeps blowing it toward the south. Even though the plane sets its course on a direct line toward La Guardia Field, it would pass far to the south. The fact that the magnetic compass discloses the plane's line of direction correctly would not help the pilot find the airfield.

What happens when ADF is on the job? Starting in position 1 (Figure 5) when the plane happens to be headed

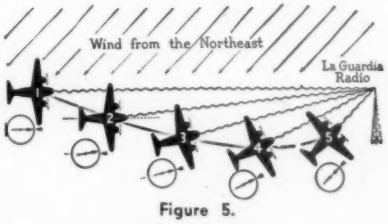


Figure 5.

toward the east on a line through the radio station, the ADF pointer rests on zero. In a short while the plane is blown far enough south so that the pointer swings left, as in Position 2. The pilot then turns into the wind until the pointer comes back to zero, and continues to steer the plane so that the ADF pointer stays right on zero. Finally, the plane approaches its destination as in Position 5, heading into the wind.

In case there is objection to taking this curved path, the pilot can fly the straight path shown in Figure 6.

To do this, the plane must be turned into the wind until the radio station is on

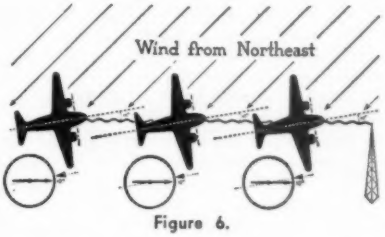


Figure 6.

the right of the plane's heading. By a little maneuvering it is possible to keep a constant angle between the plane's heading and the path of the radio wave. Suppose, for example, this angle happens to be 10° to the right. Then the ADF pointer rests 10° to the right of the zero mark. If held there the plane will home in on a straight line.

(*Continued on page* 106)

Dial of Bendix radio compass.

INCENTIVE PAY IN AVIATION

By PHILLIPS J. PECK

Labor writer, International News Service staff, Washington, D. C.

Incentive plans have proved they can increase production but they are still generally opposed by both management and labor.

AMERICAN production has been the miracle of World War II—a miracle which prompted Premier Stalin of Russia to exclaim at Teheran that the United Nations' cause would have been lost without it.

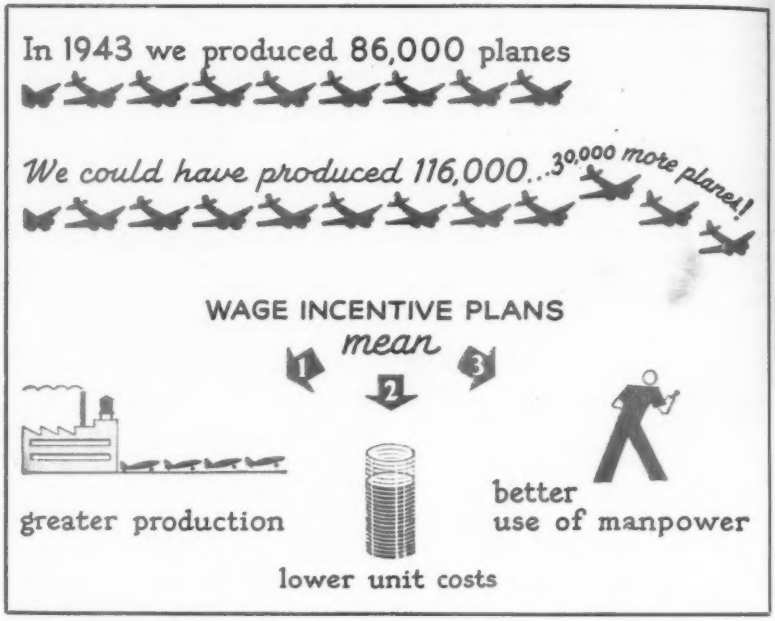
Yet the War Production Board has stated that history's greatest industrial performance could have been 35 per cent better. John W. Nickerson, director of the Management Consultant Division of WPB and author of the 35 per cent figure, presents his case in two words: "incentive wages."

The widespread introduction of wage incentive plans to encourage maximum effort by employees on behalf of war production, Nickerson believes, would have boosted United States aircraft output by 30,000 units during the past year.

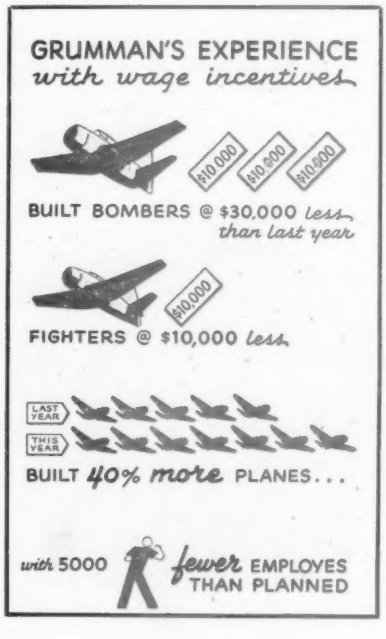
Nickerson's division, with its small staff of industrial engineers, is one of the most persistent advocates of incentive wage plans in war plants.

At the topmost level of WPB are two other staunch exponents of incentive wage proposals—Chairman Donald M Nelson and Executive Vice Chairman Charles E. Wilson, former president of General Electric.

The latter made a valiant but unsuccessful effort to "sell" the proposal in West Coast plane plants. Both labor and management objected. But the industry as a whole did not veto the wage-incentive plan. It caught on in a few plants —and with amazing success.



Hypothetical diagram of what plane production might have been with incentive plans.



For proof one need only check production performances under such plans at the Grumman Aircraft Corp., Bethpage, L. I.; Beech Aircraft, Wichita, Kans.; Republic Aircraft, makers of the *Thunderbolt;* Chance-Vought, Bridgeport, Conn.; Firestone Tire and Rubber Company's Aviation Production Division, Akron, O.; Edo Aircraft Corp., College Point, L. I.; and Pratt & Whitney engine plants.

Grumman, builders of the Navy's *Wildcats* and *Avengers,* got a 40 per cent production increase. Beech started with a profit-sharing plan, shifted to the Beech Efficiency-Incentive Plan and found that, during the first seven months following the changeover, its efficiency went up further to a level more than 28 per cent above that of the base period. Another of the group attained an increase of 20 per cent in output; a fourth, 33 per cent. and still another, 45 per cent.

Advocates of incentive wage proposals generally list three major advantages of such plans:

1. Greater quantity of production.
2. More efficient production, lowering unit costs.
3. Better utilization of manpower.

The argument might be advanced that the first advantage has lost some of its war appeal since plane production is now at an unprecedented peak. The weaknesses in this argument are that WPB is still keeping the pressure on to maintain production at its present high level and that there will have to be even greater efforts to increase airframe poundage and keep production high in the continuing shift to heavy aircraft—the giant *Superforts,* for example.

The merits of the other two factors—lowering unit costs and improving manpower utilization—are undeniable. With Selective Service calling all but a few top men in the 18 to 26-year age bracket and moving steadily toward those in the 26-to-30 category, full utilization of manpower becomes even more vital.

The accomplishments of Grumman provide a graphic illustration of declining unit costs and improved manpower utilization. Figures for 1944 show, for example, a drop of over $30,000 from last year in the production price of one particular

(*Continued on page* 122)

REFUELING THE AIRPLANE

Best fueling practice suggests that line service crew should have placed gasoline truck parallel to and about 20 feet in front of the DC-3's wing.

*Dirt and fire are constant hazards in fueling airplanes. Here is recommended safe procedure.**

SERVICING of aircraft with fuel is one of the most important duties of the mechanic. The operations are usually simple to perform but vigilance, care and caution must be exercised to avoid serious consequences. To the relatively inexperienced mechanic the dangers are thought to be of little importance and often ignored.

This attitude can cause serious accidents which can be classed into two groups: accidents from fire and accidents from failure in flight.

Three or four drops of water may cause the destruction of an airplane and the death of all those on board, by freezing into a ball and blocking the fuel lines. Serious accidents have also occurred from water in its liquid state blocking the flow of fuel through the carburetor jets.

Even a single grain of sand, to enter the fuel, could cause the destruction of a huge transport by traveling to the carburetor and lodging in the delicate metering mechanism. A wiping cloth can cause a failure by leaving particles of lint to collect on the fuel system screen and slow down or cut off the flow to the engine.

Suppose the engines required 100 octane gasoline and the crew carelessly filled the tanks with 87 octane gasoline. During the pre-flight engine run-up no trouble would be observed because the cylinder head temperatures would not be brought above normal. However, during take-off at high horsepower, the engines would overheat and vibrate due to detonation. Unless power were reduced in time, complete engine failure could easily result or the airplane might not have sufficient power to clear obstacles around the airport after take-off.

To conserve the higher grades of fuel, or in cases of emergency, it may be necessary (but never desirable) to use a lower grade of gasoline than that specified for the airplane. In this case, the officer in charge of operations must be consulted and a red warning tag, bearing specific information as to the type of fuel used as a substitute, must be attached to the control column or ignition switch so that the pilot may avoid operating the engines beyond the safe limits for this grade fuel. In case this emergency action is necessary, only enough of the lower grade should be put into the tanks to allow the plane to fly to the nearest point where the proper grade can be obtained. Then the substitute fuel must be drained from the tanks before refilling with the proper grade of fuel to avoid mixing the two grades.

Detonation, especially at high horsepower output such as at take-off, is likely to cause damage to the engines. Therefore, it is recommended, when possible, to reserve enough of the proper grade of fuel in separate tanks to be used for take-off and climb.

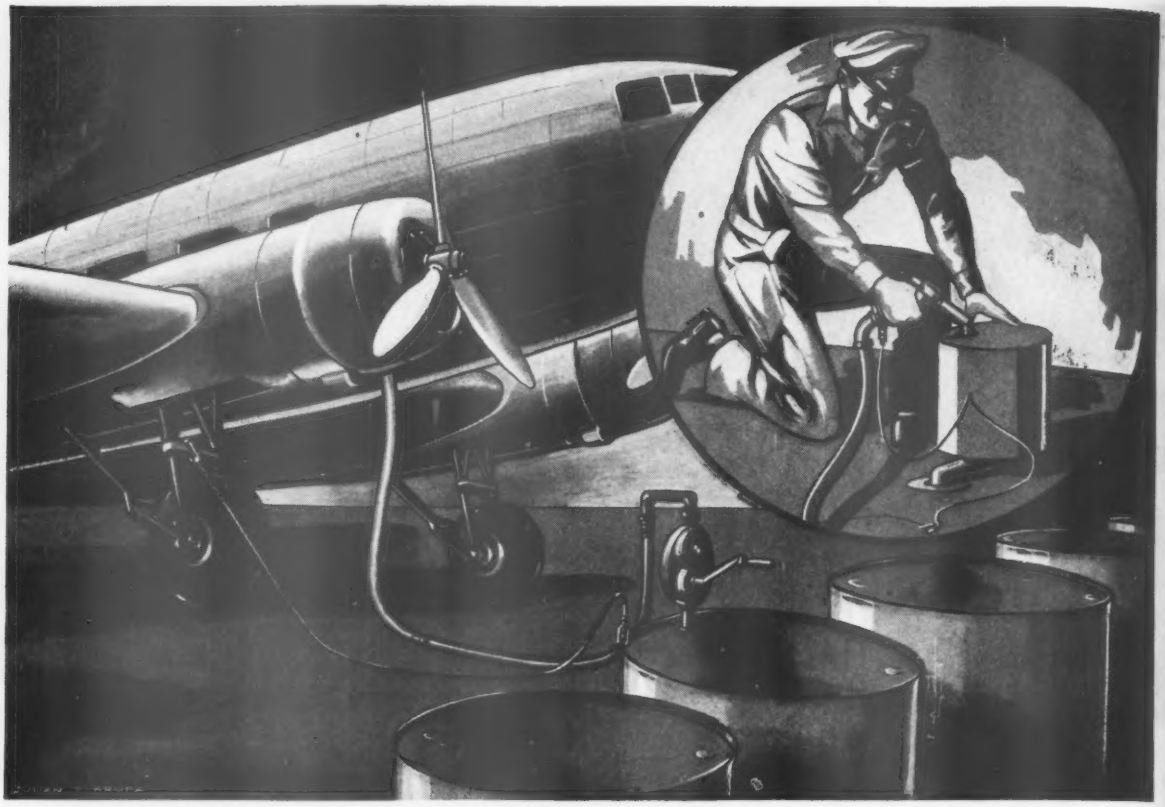
Under no circumstances should two grades of fuel be mixed to obtain an intermediate grade, since the satisfactory intermediate grade would not be obtained.

Let us assume that the airplane has arrived at the field, and is ready to be refueled. Usually it is advisable to fill gasoline tanks at the end of a flight and before the airplane is placed in the hangar. There are three reasons for this:

1. To reduce the chance of moisture condensation and consequent collection of water inside the tank.

2. To reduce the possibility of explosion due to vapors collecting inside the

* This article is based on an Airline War Training Institute booklet edited by R. G. Thomas—Ed



Sparks from static electricity start gasoline fires. Ground wires must be attached to plane and fuel supply as illustrated.

tank. In case of fire, a full tank is not as likely to explode as a partly filled tank.

3. To assure full tanks on take-off.

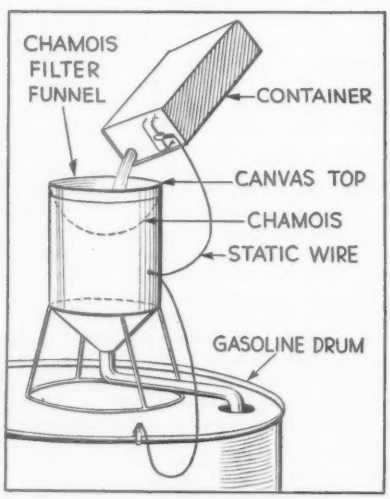
Should a fuel truck be used, the truck is driven parallel to and about 20 feet in front of the wing. Set the brakes and shut off the engine. Never drive the truck directly toward or back it up to the airplane as these positions either make it difficult to get the truck away quickly in case of fire or increase the possibility of fire when starting the truck motor if the exhaust is directed toward the airplane. This position also minimizes the danger of bumping into and damaging the airplane.

If an underground tank system is used, the airplane may be towed or taxied into position at the proper fuel pit, where the brakes are set. If taxied into position, set the brakes and stop the engines. The airplane should be positioned far enough from the pit to allow the hose to lay straight instead of coiling or kinking. If the airplane is too close to the pit, a fire at either place would endanger both.

The crew chief in charge will board the airplane before refueling and check the following items:

1. See that the master battery switch is "OFF," unless for special reasons it is necessary to leave it on.
2. See that ignition switches are "OFF."
3. See that fuel valves are in the "OFF" position.
4. See that all persons aboard are informed that refueling is being done.
5. See that the proper fluid service forms are obtained and the octane rating and the amount of fuel required is determined.

The next step is to place the fire extinguishers. There should be at least two foam extinguishers and two carbon dioxide extinguishers at every refueling. These should be placed so that they can be put into use instantly in case of fire. One man should stand by these extinguishers whose only duty is to observe, give the alarm and operate the extinguishers in case of fire.



Double static wires soldered to funnel are attached to both drum and container.

When necessary, passengers may remain aboard during refueling providing an attendant is stationed inside the cabin near the door to prevent smoking and to give the alarm and assist the passengers in case of fire. This is permitted only when passengers are sleeping or when passengers would be otherwise inconvenienced.

The "master switch" may be left on during refueling if necessary, but must not be turned "ON" or "OFF" during refueling, as its operation might cause a spark at some point in the airplane and ignite gasoline fumes. The radio or other electrical equipment must not be operated while refueling.

Before going up on the wing, the mechanic should remove all articles from his top coverall pockets so that they will not fall into the open tank, and remove heavy tools from other pockets to prevent damage by their falling onto the wing. A canvas cover should be placed on the wing to protect the metal where the mechanic is standing, and to prevent slipping in case gasoline is spilled. Household matches or cigarette lighters must not be carried by members of line service crews. These have caused several very serious fires.

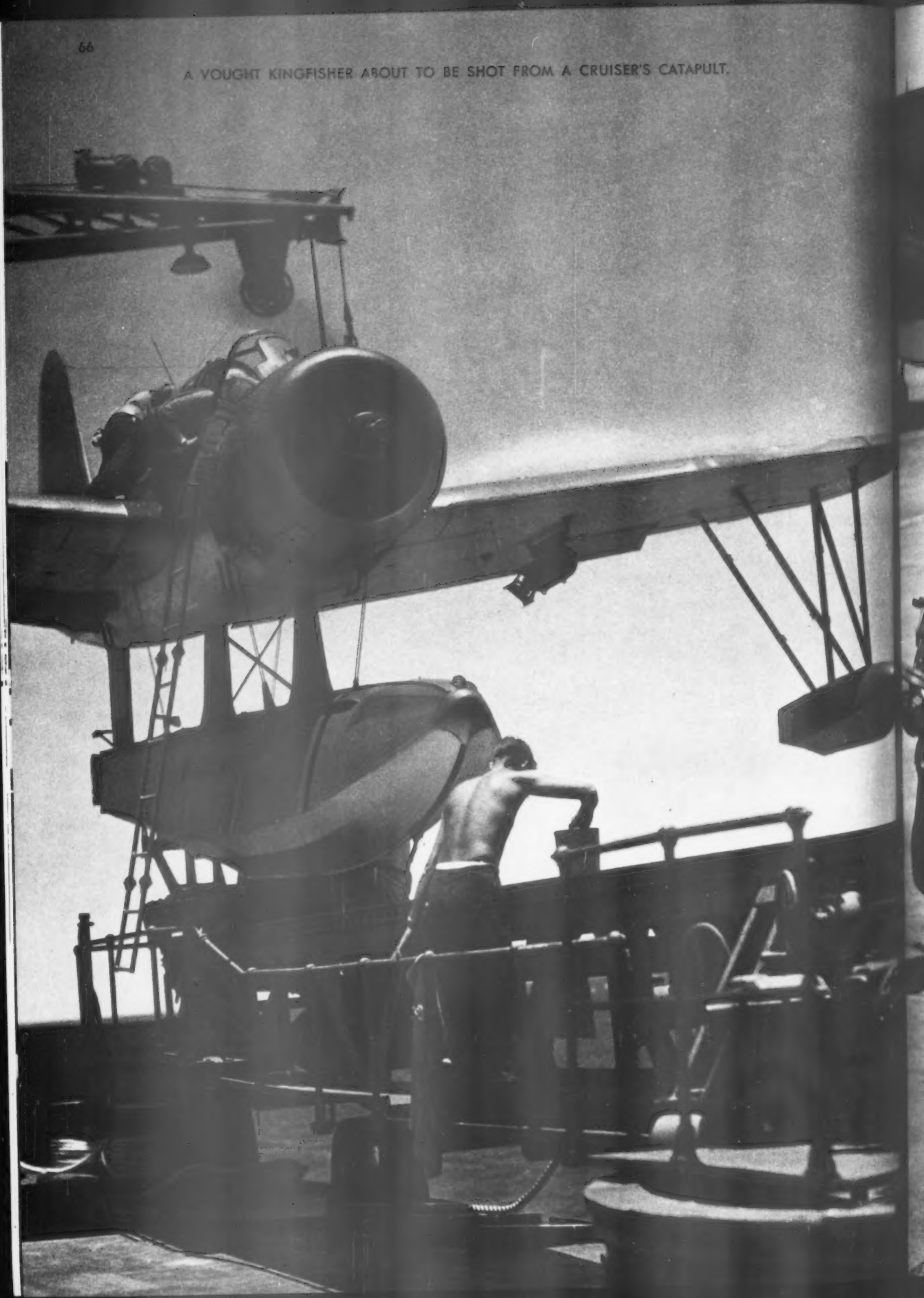
(*Continued on page* 86)

REFUELING A DOUGLAS SKYMASTER.

AN ARMY DOUGLAS SKYTRAIN TAKES ABOARD ITS CARGO.

RAF AIRCRAFTSMEN SERVICE AND BOMB-UP A HAWKER TYPHOON.

A VOUGHT KINGFISHER ABOUT TO BE SHOT FROM A CRUISER'S CATAPULT.



BACK-SEAT GUNNERS WALK OUT TO THEIR DAUNTLESS DIVE BOMBERS.

THE FAIREY BARRACUDA, TORPEDO BOMBER OF THE BRITISH FLEET AIR ARM.

THE FAIREY BARRACUDA, TORPEDO BOMBER OF THE BRITISH FLEET AIR ARM.

In every theatre of war, Hughes Flexible Ammunition Chutes, the first flexible chute to be used in combat, and Hughes-Ammunition Boosters are contributing their part in faster firepower to the many great Allied air offensives which are the brilliant achievements of highly-trained, courageous men . . . fighting with precision equipment matched only by their skill.

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The Northrop "BLACK WIDOW"

The U.S. Army's newest weapon in the night skies...designed on battle experience

When skies go dark, air warfare calls for a special kind of combat plane. Pilots discovered this during the Battle of Britain. Thus the "night fighter" was born.

From then till now, night fighters have been made-over from models originally planned for other uses.

The Northrop "Black Widow"— built on knowledge hard-won in four years of night combat — is the first airplane created especially for night fighting.

Big, venomous, secretly-equipped, the "Black Widow" has what it takes to lurk in the darkened skies . . . to keep an "umbrella" over advanced bases, airstrips, beachheads and supply lines.

Equally well, the "Black Widow" can sneak behind enemy lines . . . to cripple transportation, blast airdromes.

For such tasks the P-61 "Black Widow" night fighter has speed to spare. It can also throttle way down, almost hover in the dark. It can land slowly. And it packs terrific fire-power.

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big, venomous, secretly-equipped, the terrific fire-power.

FOR IDENTIFICATION

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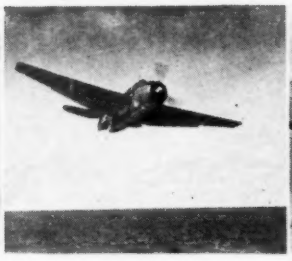

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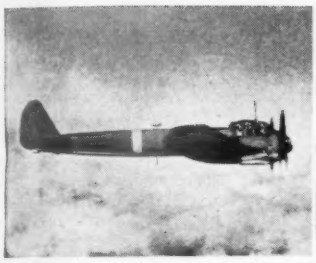

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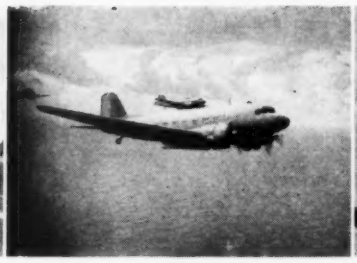

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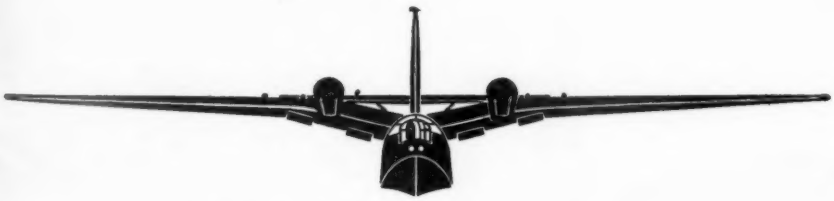
The planes are: 1. Vultee Valiant; 2. Martin Mariner; 3. Grumman Avenger; 4. Curtiss Kittyhawk; 5. Junkers Ju-88; 6. Mitsubishi Hamp; 7. Douglas Skytrain; 8. Dornier Do-18.

MISTAKEN IDENTITIES

AIRMEN and shipboard gunners operating in the Atlantic should study the differences between these two flying boats carefully. It should be noted that the German Do-24 is smaller than the *Mariner*. The American patrol bomber can be distinguished by its wing floats and twin rudders.



Dornier Do-24. Span: 98 ft. 6 in.

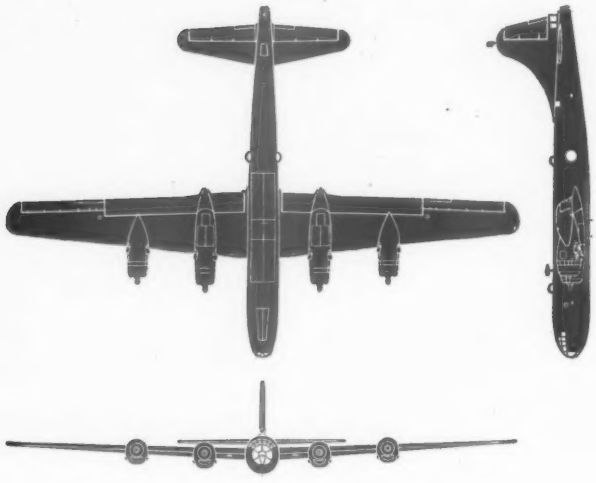
Copyright. FLYING, September, 1944.

Martin Mariner. Span: 118 feet.

big, venomous, secretly-equipped, the terrific fire-power.
MORRIS AIRCRAFT, INC. PRODUCTION CONSULTANTS

BOEING SUPERFORTRESS

Heavy Bomber



PERTINENT FACTS: Already operating against the mainland of Japan from Chinese and Indian bases, the *Superfortress* soon is expected to be based in Saipan from whence it may shuttle-bomb Japan from those islands to Chinese bases and return. The world's largest landplane bomber in operation, the B-29 is powered with four 2,200 h.p. Wright *Double Row Cyclones*. British sources say the B-29 cruisers at 250 m.p.h. at 25,000 feet (the fuselage is pressurized) and that its gross weight is about 120,000 pounds. Wing span is 141.2 feet, length 98 feet, height 27 feet. British sources also give the range as 3,000 miles with three tons of bombs. Remote-control gun turrets, not shown in the photograph or silhouette for security reasons, give the *Super* heavy firepower.

WHAT TO LOOK FOR: A mid-wing monoplane, the B-29 resembles the B-17 in many respects. The tail is practically identical. The B-29 wing, however, has narrow chord, moderate taper and square tips. There is no jutting cockpit; the transparent nose houses the pilot and co-pilot as well as the bombardier. The tricycle landing gear is fully retractable.

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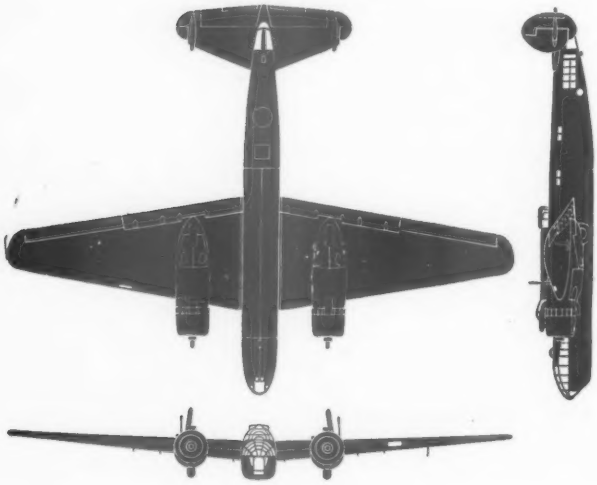
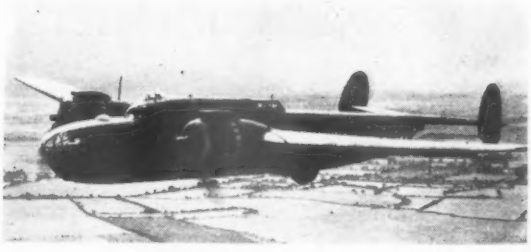
ARMSTRONG-WHITWORTH ALBEMARLE

Utility Transport





PERTINENT FACTS: Originally designed as a medium bomber, the *Albemarle* now has been converted to transport and glider-towing duties. It is powered with two 1,560-h.p. air-cooled engines. Top speed is 250 m.p.h. at 10,500 feet. Range is over 1,300 miles. Wing span is 77 feet, length 59 ft. 11 in., height 15 ft. 7 in. The prototype first flew in 1939, while the first production models flew in December, 1941.

WHAT TO LOOK FOR: The *Albemarle* is a mid-wing monoplane, with sharp taper and rounded tips on its cantilever wing. The wing, from below, looks like that of the Jap medium bomber, Sally. The fuselage is rectangular, with transparent nose and tail positions. Twin rudders and tricycle landing gear are standard.

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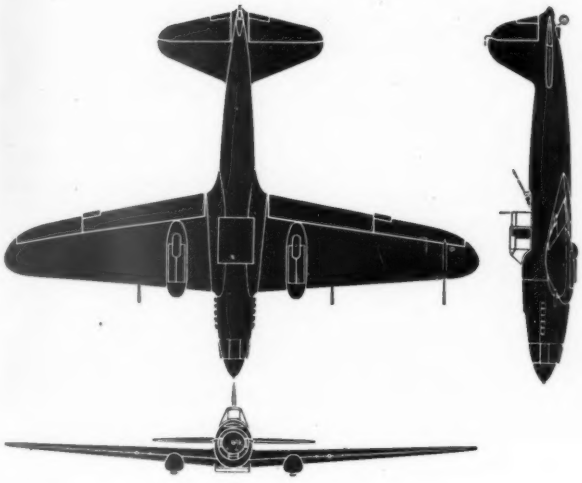
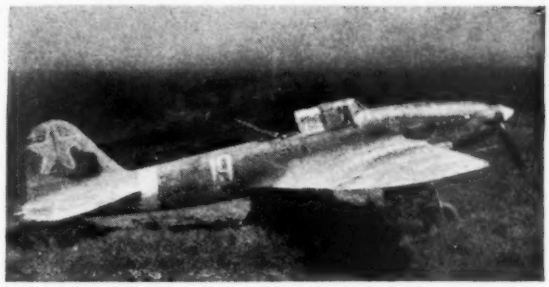
ILIUCHIN IL-3

Attack Bomber





PERTINENT FACTS: Current modification of the famed Russian Stormovik now in use is the IL-3 shown here. It differs from its predecessor IL-2 largely because of its added rear cockpit and armament. Powered with a 1,300-h.p. liquid-cooled AM-38 engine, the IL-3 is reported to have a top speed of 270 m.p.h. Wing span is 49 feet, length is 38 ft. 6 in. An attack bomber, the IL-3's pilot and gunner are protected by two forward-firing cannon in the wing, and one flexible cannon or machine gun in the rear cockpit. Like the earlier Stormoviks, the IL-3 can be equipped with wing-mounted rockets.

WHAT TO LOOK FOR: A low-winged, cantilever monoplane, the Stormovik has a tapering wing with pointed tips. The long cigar-shaped fuselage is marked by the high cockpit canopy and a flat rectangular radiator under the center section. The horizontal tail surfaces are triangular in shape. The landing gear resembles that of the American *Warhawk*, retracting backward into the wing and being marked by large "knees" on the leading edge of the wing.

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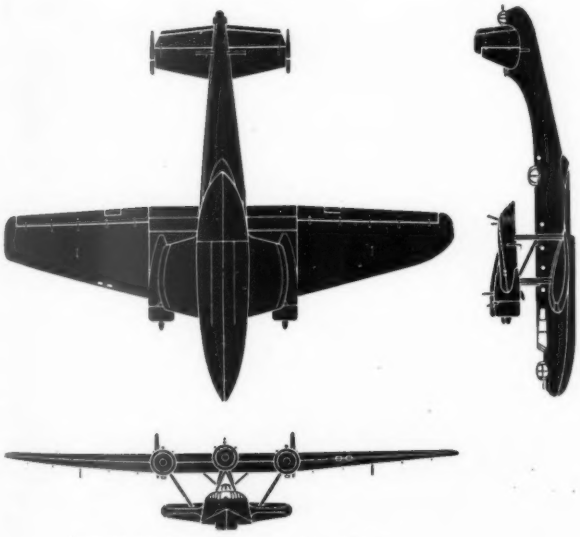
DORNIER Do-24

Patrol Bomber



PERTINENT FACTS: One of Germany's oldest but still-used flying boats, the Do-24 also was a popular airplane with the Dutch air force before Holland went to war. One of the few tri-motored airplanes still in use, the Do-24 is powered with 760-h.p. B.M.W. air-cooled engines. Top speed is reported to be 211 m.p.h., cruising speed 161 m.p.h. Range at its maximum gross weight of 29,700 pounds is 2,100 miles. Service ceiling is 18,000 feet. Wing span is 88 ft. 7 in., length 72 ft. 2 in., height, 17 ft. 10 in. Armament is three machine guns, bomb load is about 1,300 pounds. Wing loading is 25.5 lbs. per sq. ft.

WHAT TO LOOK FOR: The high parasol wing has a braced center section, sharp leading edge taper and square tips. The center engine is mounted slightly higher on the leading edge of the wing than the two outboard engines. The fuselage is marked by the large sponsons and high, twin-ruddered tail. Generally it bears a slight resemblance to the Catalina.

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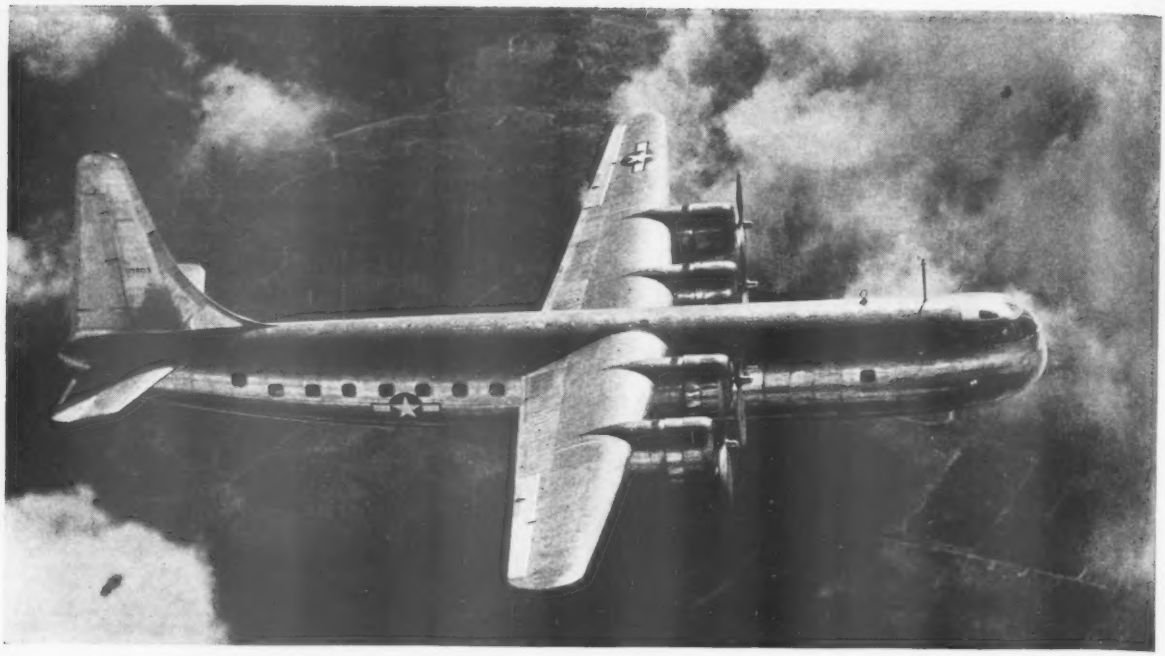


New Consolidated Liberator Liner can carry 48 passengers by day, 24 at night. It is powered by four 1,100-h.p. Twin Wasps.

HAVE YOU SEEN?

This unusual view shows the vast amount of ammunition carried for four of a Thunderbolt's eight wing guns.

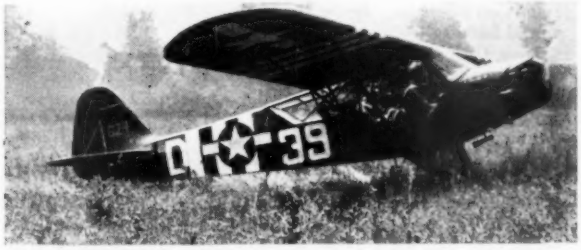
One of the first photographs of a Douglas Skymaster (C-54A) being used as glider tug. It is towing one of the Army's giant Waco CG-13 invasion gliders.

A flying scale model of a projected British twin-engined medium bomber, the Miles 39 has two tandem wings, wing-tip rudders and retractable tricycle gear.

One of the most unusual combat photographs made in the air, this one shows a Messerschmitt Me-410 diving past the wing of a Flying Fortress during an air battle over Germany. The photographer was Sgt. Victor A. LaBruno of Jersey City, N. J. The German fighter appears to have a 37- or 40-mm. cannon in its nose. Note jagged hole in Fort's wing, near the tip.

Curtiss Warhawk versatility is demonstrated by the two-place conversion (top) made by AAFTAC in Florida, and that below showing a P-40N with a belly tank and a bomb behind the tank.

These are Thunderbolts for four Allies. From front to rear, countries represented are U. S., Britain, Brazil and Russia.



The famous Piper Cub even took part in the invasion. This one was photographed just after landing in a clearing in France. Lightplanes flew liaison missions and spotted for artillery.

I Learned About Flying From That!—No. 60

By JAMES W. BURKE

Test Pilot, Republic Aviation Corporation, Indiana Division

The author prepared to bail out when his Vengeance caught fire. Then he remembered he had a passenger!

IT HAPPENED when I was test pilot for Vultee Aircraft Corp. in Louisville. I had leveled off at 5,000 feet when the cockpit suddenly filled with smoke and tiny tongues of red flame began licking at my feet on the rudder pedals. I slid my canopy open and saw that oil was escaping in great quantities and was burning in the flame from the exhaust stack.

It was high time to bid that *Vengeance* dive bomber a speedy farewell. I unsnapped my throat-mike, flung off my head-set, stuffed the plane's log book in my jacket, unhooked my safety belt, pulled the plane's nose up and started to roll it on its back. In another second I would have spilled myself out.

Then I remembered my passenger!

Long habit of flying alone had made me completely forget that one of the company officials was my passenger in the gunner's seat behind me. The Nashville factory had telephoned a few minutes before and asked him to come there for an immediate conference. He had requisitioned the *Vengeance* and me to get him there and we were now enroute from Louisville to Nashville. I recalled the job I had getting him in the gunner's seat and buttoned up. He had never before been in a *Vengeance*. I had handed him up on the wing and pointed to the gunner's compartment, indicating that he should get in. Excited by the prospect of his ride, he peered helplessly into the narrow confines of the quarters, eyed the metal seat, turned a bewildered face toward me.

"Okay," I said. "I'll help you."

Unlatching the machine guns, I swung them out of the way, placed his parachute in the seat and helped him in. Then I snapped on his 'chute harness and adjusted and fastened his safety belt and shoulder straps. Closing and locking the canopy, I reset and locked the dual guns overhead. Then I climbed in the pilot's seat and took off.

And all the while I had not given him one word of instruction of how to get out in case of an emergency!

There are some who say that a doomed man's mind functions in an extraordinary way, that sometimes he relives his entire life in a moment of time. I know that I reviewed all my flying experience during those few moments in the burning bomber. Here I was, an old-timer with long years of experience, caught in the very mistake against which I had warned hundreds of youngsters.

Pictures flashed through my mind of all the things that could happen as my passenger toiled to extricate himself. I saw him jerking at the rear section of his canopy, trying desperately to unfasten and telescope it forward, as it normally operates. I knew that he would completely ignore the emergency release pin which could instantly jettison the whole top-piece. I had not even pointed it out to him. I saw him attempting to release his safety belt and shoulder straps. There was every chance that in his fumbling excitement he would unsnap his chute straps instead. He might even pull his rip cord, filling the compartment with silk. Blown out of the plane, there was every chance that he would become entangled in the plane's empennage and be dragged down with the burning wreck.

There was no use trying to be optimistic. Were my passenger able to open the canopy, disengage himself from the seat harness, squeeze by the locked guns overhead, his chances of making it would still be slim. Without proper instruction on how to leave the plane he would probably be hurled against the extremely high vertical fin to plunge earthward, unconscious and with unopened parachute.

No! He couldn't make it, I knew that.

But the flames were gaining and my passenger did not know how to do any of the following operations:

—How to jettison the canopy.

—How to unlock and swing clear the dual machine guns overhead.

—How to release safety belt and free crash straps.

—How to uprise in seat without being blown out and hurled against the vertical stabilizer.

—How to slide out over the side, head first, and which side to go out, taking advantage of torque.

—Why he should go out the right hand side instead of trying to climb out on the wing and jump.

—Make sure his hand was on the rip cord before leaving the plane, and how to wait until he was surely clear.

—Complete instructions on how to contact the ground, land with back to wind, run with canopy, pulling at the bottom shroud lines to deflate it; in case of landing among trees or in brush, cross legs, etc.

—How to free himself from the 'chute harness once on the ground.

I looked back at my passenger. He was serenely taking in the Kentucky countryside—and as far as I could tell was oblivious to the fact that we had an oil fire in the engine. Under the circumstances I decided it was best not to inform him. It could only add to the hazard.

I had one chance. Fort Knox, I remembered, was about 15 miles on my right with its splendid Godman Field.

There were breathless and anxious moments before the long, beautiful runways of Godman came into view. I cut the engine and made a glide for the nearest one. Fire trucks met the *Vengeance* and asbestos-clad men swarmed over it instantly.

Neither my passenger nor I were scorched. But I've learned my lesson.

Should you ever take a ride with me, you can expect a clear-cut, exact, precise drill on how to bail out in case of an emergency. END

After the war you can fly to thousands of towns and resorts in your Piper Cub . . . with utmost safety and economy. Your pleasure trips will be full of fun—your business trips fast and enjoyable. Then every wide-awake community will have landing facilities.

Farsighted mayors are planning inexpensive landing facilities today—for you—for their sons and daughters upon their return from Service—for the town's own welfare.

Business in towns and cities with peacetime landing facilities for light planes will prosper. People will flock in their Piper Cubs to the places that are ready.

Get this FREE Booklet NOW!

Your community should plan one or more inexpensive landing areas today! A new booklet, "What Your Town Needs for the Coming Air Age," illustrates and describes landing facilities. For your free copy, write Piper Aircraft Corporation, Department PA94W, Lock Haven, Penna.

GET YOUR AVIATION BOOKLET, TOO—"Piper Cub . . . In War and In Peace." Full color, 32 pages. Covers history of light plane, Piper Cub planes, coming air age, how to fly. Enclose 10c in stamps or coin for postage-handling. Write Piper Aircraft Corporation, Department PA94, Lock Haven, Pennsylvania.

PIPER Cub

Points the Way to Wings for All Americans

Letters

SUPERFORTRESS

Sirs:

In the interest of accuracy we call your attention to the official and correct spelling of the new Boeing *Superfortress.*

Superfortress is:

1. One word.
2. No hyphen.
3. No quotes.
4. Please capitalize.

The Boeing *Superfortress* was designed, engineered, developed and is built by the Boeing Aircraft Company.

THOMAS F. COLLISON
N. W. Ayer & Son, Inc.
New York, N. Y.

ILLEGAL LADIES

Sirs:

Undraped female figures may be illegal insignia for our fighting planes—as was pointed out in the June issue of FLYING—but they still get around.

Among the *Liberator* bombers that come to our field for overhauling after overseas missions was one voluptuously designated as the *Liberty Belle.* Although the plane arrived in the hangar with its decoration completely covered with masking tape, curiosity got the best of us. Not until some of the more modest of the women workers insisted was the *Belle* properly clothed—in paint.

But the *Belle* was only one; there was the *Ubangi* and many others that might as well have been deprived of the little clothing they had.

It seems right to me that our fighters have a sense of humor and that they do think of the women. And I'll wager that there's nothing much the War Department can do about it.

MIRIAM GREENBERG
Chicago, Ill.

NO HOAX

Sirs:

Just what sort of a hoax was perpetrated in the picture which appeared on the cover of the August issue of FLYING? I've seen a lot of different planes since wartime production began, but never one painted a brilliant red and bearing, in box-car letters, the undignified appellation "Yippee!"

BUD FONTAINE
Chicago, Ill.

● To celebrate the completion of their 5,000th *Lightning,* Lockheed workers painted *Lightning* No. 5,000 (a P-38J) just as it appeared on the August cover. Our photographer was on hand to record the justifiable display of elation, the test pilot co-operated, and the result was the Kodachrome on the August cover.—ED.

FUEL PRESSURE AND TRIM TABS

Sirs:

In the article, "Pilots, Meet the Kadet," in the June issue of FLYING I have found two errors. I believe that if you check with an authority you'll find I'm right.

In pictures 23, 24, and 35 you have a chart and instruments which indicate that there should be three pounds per square inch of fuel pressure. But tanks are in the top wing and the fuel system depends upon a gravity feed. Therefore the fuel pressure should read "0."

The second error is in picture 20. It shows the trim tab set in nose-down position at approximately 3 o'clock. It would be difficult to take off with the tab in this position due to the forward pressure on the stick. The tab should be set at 10 o'clock for the best results on take-off.

ENS. A. C. MCMORRIS
Sqd. VN4D8, Barin Field
Pensacola, Fla.

RIGHT OR WRONG?

Sirs:

I have been an ardent admirer of your magazine ever since its inception. But never before have I seen so much misinformation as that contained in "Our Firepower Developments" in the June issue of FLYING. An Army ordnance or armament officer would never refer to .50-caliber and .30-caliber guns. Those are Navy designations which refer to barrel length. The Army uses Cal. .30, Cal. .50, etc.

The writer also errs in saying that we named the Douglas night fighter the *Havoc.* The plane was so designated by the British before we adopted names for our aircraft. Neither is it correct to say that the Douglas B-19 needed power turrets "before the British or any other country turned attention to the power-operated turret." The British were using power-operated turrets when Douglas was building nothing but biplanes. Boulton Paul, Ltd., had placed the original version of their present turret in a plane as early as 1931.

Other discrepancies have to do with small armament. I'm as much an American as anyone, but that doesn't alter the fact that we copied our infantry arms from the Germans, our projectiles from the French, our machine guns from the Belgians. Our best aircraft cannon has a remarkable resemblance to one that bore the name "Hispano-Suiza."

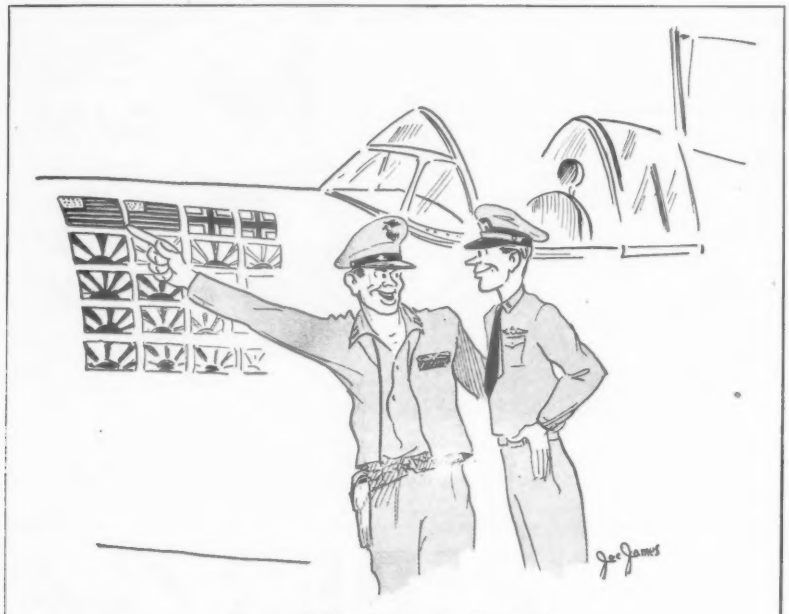
Our only original development is the Garand. This infantry piece stepped up our firepower but cut down on our effective range because we had to use the old M-1 ammunition in it. For 20 years our ammunition had been as good as any. Then came the Garand with its delicate innards and we went back 20 years to 150-grain flat base low pressure ammunition.

The bazooka is good, but can we claim credit? The Germans and the Russians have used rockets for years.

That's all the beefing for now—hope it won't destroy a long and beautiful friendship.

M. E. ABBOT

● The article referred to in the foregoing letter was reprinted from Air Force, the official AAF service journal, compiled and edited by Col. Frank C. Wolfe. Like other magazines, FLYING must follow a consistent style, cannot use ".50-caliber guns" when writing a Navy article, "Cal. .50 guns" when writing an Army article, whatever the styles of the two services may be. Reader Abbot is right about the *Havoc.*—ED.



"... and these two I ground-looped!"

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While bulldozers speedily repair conquered air fields and supplies are being rushed in, these speedy, manueverable Continental Powered Planes, which can take-off from and land on unbelievably small spaces, search out enemy positions and direct our artillery fire. These planes have Red Seal Power because more dependable power has never been built.

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

YOUR DOLLARS ARE POWER, TOO!
BUY WAR BONDS AND KEEP THEM

THE LIBRARY

FOGS, CLOUDS AND AVIATION, by W. J. Humphreys; published by Williams and Wilkins, Baltimore, in 1943. 200 pp. Price $3.

One of the best popular books on the names and method of formation of different types of clouds and fogs was "Fogs and Clouds" by W. J. Humphreys, published in 1926. This book is now little known so it is well that Williams and Wilkins have revived it under the title "Fogs, Clouds and Aviation" by W. J. Humphreys and dated 1943.

The only noticeable change so far as "aviation" is concerned is that a sentence or two has been added at the end of the discussion of some cloud types telling that the aviator can hide from the enemy above or within this type of cloud. One sentence on ice is also included under one cloud type. In some way these few sentences are used to justify adding the word "aviation" to the former title. Those who have had some contact with aeronautical meteorology will immediately recognize most of the cloud pictures as being the same ones used in one or more of the following publications: "Physics of the Air" by Humphreys 1920, 1929, "Fogs and Clouds" by Humphreys, 1926, "Cloud Forms" by the U. S. Weather, 1928, and "Aeronautical Meteorology" by Gregg, 1930.

No mention is made of the relation of clouds to fronts and air masses. This omission was satisfactory in 1926 but seems strange for a book on clouds and aviation in 1943.

The bibliography lists nothing later than 1926 (which was the date of the original Fogs and Clouds"). This is unfortunate since any innocent purchaser of the book, dated 1943, who refers to the bibliography for further books on clouds will not be told that a number of excellent publications have appeared during the past 17 years and are probably more readily accessible because of their more recent date.

No one writes more entertainingly than Dr. Humphreys and the cloud pictures are good or they would not have such a long record of use. Therefore the book is recommended for the casual reader who has no contact with meteorology but who is interested in learning cloud names and some interesting facts concerning them.

W. H. KASTER
Superintendent of Meteorology
United Air Lines

STICK AND RUDDER, by Wolfgang Langewiesche. Published by Whittlesey House, McGraw-Hill Book Company, 330 W. 42nd St., New York City, in 1944. 389 pages. Price $3.75.

Wolfgang Langewiesche is certainly one of the nation's most lucid aviation writers, particularly when he gets on his favorite subject, the art of flying. His newest book does honor to his reputation. It is virtually a "must" for pre-flight students and even many experienced pilots have much to learn from it.

Langewiesche believes that many accidents and most inept flying are caused by the "wrong pictures" in the heads of the pilots on exactly how their airplane flies. Following these mistaken mental pictures leads pilots into trouble.

With numerous diagrams and plain language, Langewiesche attempts to correct the mistaken concepts of beginning flyers. His book is so fresh in its approach, so "different," that it virtually unfolds a new world to the aviation novice. It explains so much that he hasn't understood before. It reveals so much that his instructor has left unsaid.

Typical of Langewiesche's writing, which in this book covers nearly all the beginner needs to know in handling a plane in the air and landing it is the following statement accompanied by illustrations:

"The airplane keeps itself up by beating the air down. If one could lay a smoke cloud into an airplane's path, the airplane, in flying through it, would squash it down."

The book contains an appendix by Leighton Collins on "The Dangers of the Air," which represents a synthesis of Collins' years of studying air accidents.—CURTIS FULLER.

"ROGER WILCO" ABC OF RADIO FOR FLYERS, by Lieut. Adras P. LaBorde, A.C.; published by Military Service Publishing Company, Harrisburg, Pennsylvania in 1944. 114 pp. Price $2.

Here at last is a handbook on radio for flyers that is written by a flyer. Lieut. La Borde has presented the basic material about the importance of radio gear to civilian and military pilot alike.

This book is written in an easy and familiar style which gives the reader the impression that he is "sitting in" on one of the author's classes. The author presents a vivid picture of the role which radio is playing in this war based on his own experience and advises the student on the importance of every piece of radio gear with which he will come in contact.

The correct methods of transmitting and receiving, operating procedures and proper phrases are all covered. Complete appendices are included which give frequencies, code, prosigns, correct sequence for a position report and other valuable data for the flyer.

This is by no means an ordinary radio text, inasmuch as the author has deliberately omitted all technical data except that essential to the flyer. There are no long involved explanations regarding the "why's and how's" of radio but a clear exposition of the use and methods of operating the radio equipment with which the pilot must become acquainted. This book will not make the reader a radio technician but he will be a much more thoroughly trained pilot if its information is taken to heart.—PRISCILLA HOEFER.

FLYING

"All I know is I'm supposed to lug it over to the airstrip. No one said nuthin' t'me about loadin' it on the truck."

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Valves—that's what these are—and their innocent appearance serves only to conceal their importance. For these valves are to modern warfare what the famous "horseshoe nail" (for the want of which the battle was lost!) stood for in the simpler fighting days of two hundred years ago. Designed for the control of oil, gas and other fluids, they are in active wartime service in aircraft of all types on every fighting front.

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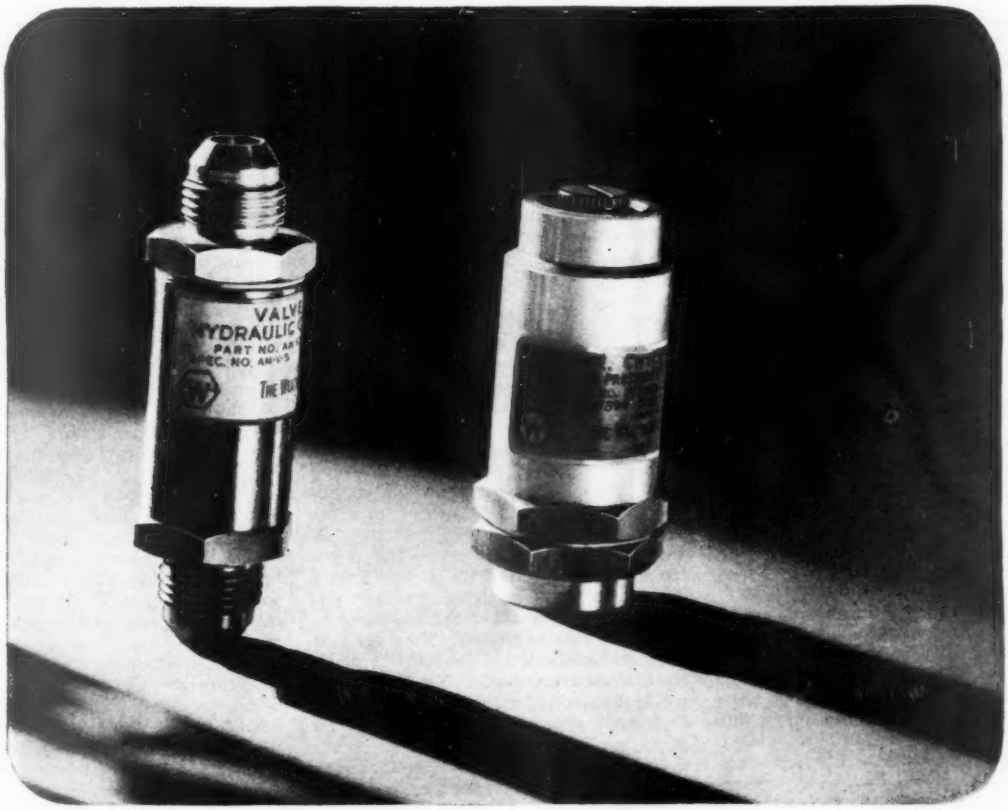

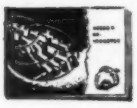

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AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA) with National Service Office located in the Carpenters Bldg., Washington, and Registrar's Office in the Michigan Square Bldg., Chicago, is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special Bulletin is sent each month to all registered AOPA pilots and also confidential memorandums from AOPA's Washington staff are sent members from time to time.

INSURANCE FOR PILOTS

Non-scheduled aircraft pilots may obtain accident insurance to supplement their life insurance from several reputable companies by paying a premium of approximately $20 per year. These supplements pay $3,000 in the event of death through aviation accident, plus certain payments for permanent injury such as loss of an arm or a leg, and $500 medical reimbursement.

Why is it, then, that ordinary life companies are continuing to charge premium rates covering the aviation risk which run anywhere from $20 to $50 per thousand for insurance or an average of 75 per cent more for the risk that is being successfully underwritten by accident companies. The question is entirely fair since the extra premium loading which a pilot has to pay on his ordinary life policy does not increase the cash value of his insurance. It is, in fact, a form of extra rate term insurance except that it is automatically renewable, which is not the case with accident policies.

Equitable Life Assurance Society reports that during a four-year period when air travel was treated on the same basis as any other form of transportation only 22 claims were made on fare-paying passengers out of a total of 61,000 death claims. This, we believe, is an indication of some common sense analysis on the part of life insurance companies to appraise insurance risks properly.

Pilots in every state in the Union have asked AOPA to do something about this confused insurance picture. Preliminary studies conducted by AOPA indicate that not only is there no uniformity among insurance companies in the calculation of aviation insurance risks, but that within the same companies there is a great latitude of appraisals and premium charges among policyholders having approximately the same pilot experience and age brackets. It would seem to indicate that the extra premium charged in an individual case may be greatly influenced by the degree or manner in which the particular applicant's case is presented to the insurance actuarial department.

This is a bad situation. It is bad from the aviation standpoint because the extremely high premiums which many insurance companies quote give a false appraisal of the safety factor in flying. It is equally, if not more, damaging to the insurance companies themselves, since these rate differentials are going to create bad will among policyholders when they discover that some other chap in equal circumstances has received the benefit of lower premiums.

AOPA intends to pursue this investigation of the irregularities in establishing extra premium rates for aviation risks. We will solicit the assistance of federal and state insurance departments to determine why a greater degree of standardization has not been attained and why extra premium rates remain proportionately high on life policies when accident policy rates have been adjusted downward in accordance with actuarial figures now obtainable.

WHAT ABOUT PHYSICALS?

SOME time ago AOPA advocated the complete elimination of physical examinations for pilot licenses. Our contention was that reliance should be placed on the student instructor as to whether a man could fly safely. We proposed that, if the Government were not willing to make this change in one step, the first move should be to terminate the present system of CAA-appointed special flight examiners and rely upon a single medical examination given by the *family doctor* who is in a better position to know the health condition of the flyer than some totally strange Government-salaried examiner.

We are still strongly for this change. A vast majority of the pilots who have written AOPA also favor it. A few letters have been received from doctors connected with the CAA medical department who take exception. They say that a family doctor is not *qualified* to make the medical examination. This argument, we believe, completely ignores the fact that most physicians have spent years preparing for their medical careers. It even appears that we have another case of a Government department trying to perpetuate itself.

Some states likewise have instituted state aviation medical departments which, at a cost to the pilot, conduct "super" physical examinations. Upon questioning these state groups, AOPA has been told that the state conducts the medicals strictly to assure safety. When asked why they do not accept the CAA medical examination, we are told that the CAA examination is unsatisfactory. All of which merely serves to question further the need for any examination, and considerably strenghtens our original contention that the present Federal and state medical appointees are profiteering in the name of flying safety.

Let's give this matter some action and get rid of the burden of medical examinations. It is an unnecessary expense. It creates an untrue conception of physical requirements for pilots. To put it bluntly, it scares away customers. The examinations themselves are of doubtful value and, according to competent medical men, the same job can be done (if it is necessary at all) by the family physician who, CAA notwithstanding, is a *qualified* professional man adequately trained to give eye tests, determine medical histories, and analyze heart beats.

All pilots who agree with AOPA's policy may assist in getting present medical requirements changed by writing to the Safety Rules and Educational Division of the Civil Aeronautics Board, Washington 25, D. C. We suggest you make your comments brief and to the point—immediate elimination of Governoment exams.

CIVILIAN LICENSES FOR MILITARY PILOTS?

The CAB has announced that it is considering a change in the regulation relating to the availability of civilian licenses for members of the armed forces. It is now proposed that the license shall be made available to members of the armed services while they are still on duty, or after they have returned to civilian life, but not to exceed 12 months from their date of discharge.

The present CAA regulation will not permit issuance of the license until after discharge and then only if the application is made within six months after separation from the service.

It is also proposed by CAB that a transcript of the pilot's military experience, including a breakdown in horsepower classification, plus a written examination on the Civil Air Regulations, will be required.

AOPA has gone on record as favoring the automatic grant of civilian licenses to all rated military pilots who may make application for them and without any form of written or physical examination by CAA. In our confidential bulletins of previous months and in these columns we have emphasized the need for granting civilian pilot certificates to members of the armed services if aviation is to retain them following the war. We are, therefore, pleased to see CAB taking hold of this problem. It should be pointed out, however, that the program will be entirely defeated if it is scrambled up with a lot of unnecessary, impractical, and unattainable requirements. It will not be easy and—in most cases it will be impossible—for pilots to get the information which is required under the present proposal. Anyone who has had active combat flying has more than proved his piloting skill and ability. The usual requirements should be waived, therefore, and the granting of a proper civilian pilot license should be made an entirely automatic process. END

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Refueling the Airplane

(*Continued from page 62*)

The next step is to make sure the correct measuring stick is used and to measure the amount of fuel already in the tanks. Always wipe off the stick with a clean cloth before using. Enter the quantity of fuel already in the tanks on the service forms, and replace the fuel cap. Check the data on or near the fuel tank cap, which should tell the octane rating of the fuel required and the fuel tank capacity. Make certain at this time that you have the proper pit and the proper hoses for the octane grade of fuel required.

Precaution against fire from static sparks is important and should be taken in the following order:

1. Secure one end of the static grounding wire to a *bare metal* part of the fueling system of the truck or at the pit. Then secure the other end of the wire to a *bare metal* part of the airplane, not too near the fuel tank filler cap. A bare metal part of the landing gear may be used unless a special ground plug is provided.

2. Before passing the nozzle up to the tank, it should be touched against the airplane so as to equalize any static charge that might be present. Then pass the hose up to the tank opening. Always pass the hose onto the wing at the *leading edge*. It is not advisable to pass the hose over the trailing edge, as this part of the wing is not structurally strong enough to support the heavy hose. Also, never drag the hose over de-icer boots or fabric covering. Lift the hose and lay it on the wing carefully.

3. A short static grounding wire is attached from the nozzle to the bare metal of the airplane near the tank opening. These static ground wires now form a complete electrical circuit to discharge static electricity continually as it is developed in the hose, fuel lines, nozzle or tank.

4. Remove the fuel tank cap and hold the nozzle into the opening, being careful not to damage the filler neck. The fuel pump may now be started and the nozzle opened for filling the tanks. Never leave the nozzle unattended while fuel is flowing, as the force of the fuel may cause it to work out of the tank opening.

Nozzles should be opened and closed slowly. This lessens the danger of damaging the airplane tanks by sudden impact, or damaging the pumps, hoses, nozzles and metering system by suddenly stopping the flow of gasoline.

FLYING

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In cases where a full fuel load is not required, take stick measurements frequently to avoid putting in too much and then having to drain the excess fuel off.

Fuel tanks must never be filled to the point of overflowing. When fuel is stored in underground tanks it is usually cooler than atmospheric temperatures, and if the tanks are filled to the limit and left in the sun or the plane taken into a warmer hangar, the gasoline will expand and overflow, creating a serious fire hazard. The greatest amount of fuel allowable in the tank is the greatest amount shown on the measuring stick and filling beyond this point may result in overflowing.

As each tank is filled to the required capacity, shut off the fuel at the nozzle. Replace the fuel tank cap before disconnecting the static wire. Follow the same procedure for each tank and when all tanks have been serviced record the quantity of fuel in the tanks on the fuel service forms.

After each refueling, about one quart of fuel should be drained from each tank sump in the airplane or at the lowest point in the fuel system where a drain valve is provided for this purpose, to remove any water that may have condensed there or may have been pumped in. This should be drained into a glass container so that water and dirt can be detected easily. Never drain the sumps by allowing the gasoline to spill on the ground or hangar floor. (The sumps should be drained again before departure if the plane is not to take-off immediately.) Always safety the drain valves after each draining.

After the sumps have been drained, the fire extinguishers may be returned to their proper locations and the airplane moved for further servicing, storage or departure.

A hand fuel pump is the usual method for refueling from drums at temporary or emergency landing fields where there is no permanent fuel system. The following procedure should be followed:

1. The pump, bronze bung wrench, static ground wires, and funnel should be inspected and prepared for use.

2. The required number of drums (50 U. S. gallons per drum) should be taken from storage. Clean the bung end of the drum and stand the drum on end. Test the drums for water by removing the bung and using litmus paste or water testing paper. The bung is replaced after testing each drum.

Testing with litmus paste or water-testing paper is the easiest method. Litmus paste is a gray-colored paste that is not affected by gasoline but turns bright red when in contact with water. A thin strip of litmus paste about twelve inches long is spread on one end of a narrow piece of wood which is long enough to reach the bottom of the drum. The drum is placed on end and the large bung removed. Then the litmus end of the stick is lowered into the drum until it touches the bottom and then withdrawn. If water is present, the litmus paste will indicate the amount by the length of the stripe that has changed color from grey to red.

If water-indicating paper is used, a strip of the paper is tied to the end of the stick

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and the test made in the same manner as using the paste. Be extremely careful that no piece of the paper becomes loose and is left in the gasoline.

If water is found in a drum, it should be removed before pumping out the gasoline. A small scavenger pump is the easiest method.

3. The drums are placed at a safe distance forward of the wing, grouped as required for each tank and stood on end with bungs up.

4. A static ground wire is attached, one end to the first drum to be emptied and the other end to the airplane. The filter funnel is passed up to the tank opening, and one of the funnel grounding wires is attached near the tank opening, then the cap is removed and the funnel spout inserted in the tank.

5. The nozzle is passed up to the attendant and the second funnel static wire is connected to the nozzle, completing the circuit.

6. Remove both bungs from the first drum and insert the pump suction pipe. Pumping may begin now. When the first drum is emptied, remove the static ground wire from the first drum and attach to the second. Remove the bungs from the second drum and install the pump. Then replace the bungs in the empty drum before pumping.

7. The fire extinguishers should remain at the airplane until the final operation of draining the fuel sumps has been completed.

It is sometimes necessary to refuel the airplane by using cans if no pump is available, or the tanks may be "topped off" in this manner if only a small amount of fuel is required. This operation is hazardous and the proper use of safety measures must not be neglected, even if only a small amount of fuel is needed.

Any clean, closed convenient-sized container may be used. Either a five-gallon or a seven-gallon capacity is considered best. The following detailed procedure should be followed:

1. The airplane is positioned and fire extinguisher and emergency measures followed as previously outlined.

2. The airplane must be grounded by a static wire to a clean metal unpainted rod driven into the ground or to some metal structure that would carry off a static charge into the ground.

3. A hand fire extinguisher is placed near the tank opening, and additional extinguishers placed nearby on the ground.

4. The funnel is grounded and inserted in the tank opening as previously outlined.

5. The container cap should be loosened but not removed before the can is handed up to the tank, so that no difficulty will be encountered in removing the cap at the funnel.

6. The second funnel grounding wire is attached to the handle or edge of the can before the cap is removed, and it is not detached until the can is emptied and the cap replaced. Cans should be removed from the areas emptied and any spilled gasoline must be wiped up immediately. Handle cans carefully and do not throw them off the airplane or toss them from one man to another. Many persons have been injured in this way and the cans are easily damaged.

7. Refuel each tank in the same manner and when all tanks are filled, drain the fuel tank sumps. Put away fire extinguishers and other equipment.

It is very often necessary to remove the fuel from an airplane tank so that it can be removed or repaired. This operation is no less hazardous than filling the tanks and may be even more hazardous unless proper facilities are available.

When possible, de-fueling should be done in an open uncongested area well away from buildings and other airplanes and at a location where the wind will not carry the vapors toward working areas or places where they might be ignited.

If the de-fueling is to be done inside the hangar, the main doors should be opened and all shop doors leading into the hangar closed. No work is to be done or equipment operated in the hangar or near the area which would cause the vapors to ignite.

Where the fuel system is designed for either fueling or de-fueling, or a power-driven portable system is used, the procedure is practically the same.

If a hand pump is used, the pump suction pipe is replaced by a length of hose and the pump mounted solidly to a bench or table on the ground. (Never try to use the pump on the airplane wing.) The bungs are loosened but not removed until ready to fill. Static ground wires are used to connect the airplane to each drum as it is being filled and to connect the nozzle extension to the airplane near the tank opening. As the drums are filled, the bungs should be screwed in and tightened. The drums should not be moved until de-fueling is completed as sparks may occur while fumes are present.

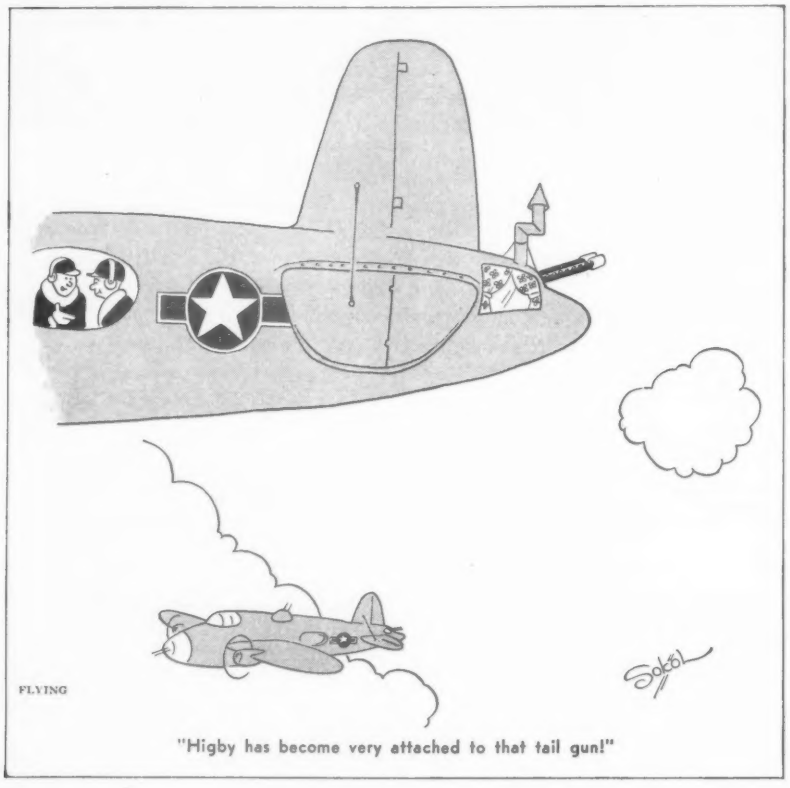
If no pump is available, the fuel must be drained from the tank sump or fuel system drain valves. The cans should be held as close as possible to the drain outlet, with a static wire connecting the can and the airplane. When pouring the fuel from the can to the drum, a funnel should be used, with static grounding wires connecting the drum, funnel and can.

Static electricity has been the cause of a great many fires and is a dangerous and ever-present hazard in aircraft servicing. Unfortunately, it cannot be seen until it sparks and then it is often too late to take the necessary precautions to avoid fire.

Even while on the ground, the airplane may collect a considerable charge by the action of wind and dust passing over the surfaces, or from the propeller blades while running the engines. Static may often be seen discharging from the propeller tips while running the engines at night. Wiping the airplane surfaces with cloth, or walking through the carpeted cabin can build up static charges unless the airplane has a grounding wire fitted to discharge the static.

Static grounding wires, sometimes called static wires, are standard equipment at all stations and must be installed on the airplane at all times while it is on the ground. These grounding wires must have strong metal clips or clamps soldered to each end, and when installed, one end must be securely attached to a clean, unpainted metal surface of the air-

(*Continued on page 92*)



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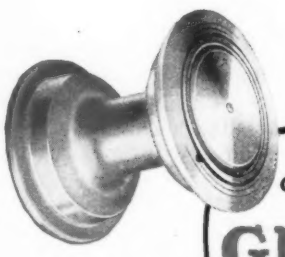

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INVEST IN VICTORY — BUY BONDS

(*Continued from page* 88)

plane and the other end to an unpainted metal rod driven into the ground or to some metal structure that is approved for grounding purposes.

When refueling the airplane, static charges are developed by the friction of the gasoline passing over the inner surface of the hose.

Gasoline on the skin will cause severe irritation and possible lead poisoning, especially under the clothing. If gasoline is spilled on the body or clothing, the clothes should be removed and the body washed with soap and water immediately. Do not wear the clothes again until they have been laundered, as merely drying out the gasoline will not prevent skin irritation. If the skin becomes irritated, rub well with olive oil or vaseline until medical treatment can be obtained. The breathing of gasoline vapors is highly dangerous.

There is very little danger of lead poisoning from swallowing leaded gasoline, but serious illness and irritation of the throat and stomach may result. The victim should be given warm salt water to induce vomiting and medical treatment as soon as possible. If gasoline gets into the eyes, they should be washed out immediately with a solution of boric acid or fresh water. Then apply castor oil, olive oil or mineral oil.

All gasoline must be filtered as it is put into the airplane tank. Sometimes a gum-like corrosion substance clogs the funnel screens, especially if the gasoline has been stored in galvanized metal containers. It is easily removed by washing the screens in a solution of 10 per cent hydrochloric (muriatic) acid and 90 per cent water, and then rinsing thoroughly with fresh water.

Chamois filters must be washed frequently with soap and water. A new chamois should not be used until it is thoroughly washed, because of the chemical action of the leaded gasoline and animal oil in the chamois. Always be sure the chamois is perfectly dry before using. A damp chamois will not permit a rapid flow of gasoline and will allow water to pass through. Always use the same side of the chamois so that previously collected sediment will not enter the tank. Never tie the chamois skin over the end of the discharge nozzle or use it in any manner that will cause the fuel to filter through the chamois under pressure.

Funnels should be made of brass or copper so that there will be no danger of sparking from a blow. Two ground wires should be soldered to the funnel. END

Education for the Air Age

(*Continued from page* 51)

crease. The educational commission favors a limited amount of flight experience for all students as part of the course's laboratory work. Reports from California indicate that approximately 25 per cent more high schools taught aeronautics in 1943-44 than in the previous school year. At least 75 per cent of them are teaching aeronautics in one form or another. The largest increase has been in the largest schools—in those with 500 or more students. There was a decline among the high schools with less than 200 students —which suggests that the staff and equipment problems of the smaller high schools have yet to be solved.

Wisconsin is an outstanding example of how air age education is progressing. The Wisconsin Plan was drawn up by a committee democratically composed of members of the State Department of Education, an experienced flight school instructor and operator, a representative of the Aviation Education Service of the Civil Aeronautics Administration and representatives of Wisconsin schools from elementary of college level.

The plan recognizes that aviation should begin in the elementary schools. "Basically, this is a program to modernize much of the elementary curriculum in view of the impact of the Air Age. Special courses are not recommended but units on aviation are appropriate in many pupil activities in all elementary grades."

In high schools, the committee recommends the incorporation of aviation material into such courses as geography, history, biology, general science, physics, mathematics, social studies, English, foreign languages, fine arts, and industrial arts.

But the most significant recommendation deals with the establishment of courses on the science of aeronautics in all high schools. The immediate teaching of such courses is "necessary," this committee of educators declares, for the following reasons: "(a) to develop scientific instruction within the framework of general education which will teach important principles of science more effectively; (b) to assist students to understand the social significance of the airplane in war and in peace; (c) to provide a background for participation in the development of private flying and air commerce in the post-war world; (d) to prepare students for training in the military air services; and (e) to assist students to prepare for the Civil Aeronautics Administration private pilot ground-school examination."

The classroom side of the course not only "should cover the important phases of elementary aeronautics, but it should also be organized so that other phases of modern science, such as radar and electronics, might be included."

The report breaks down the general purpose of the course and outlines the specific objectives to be sought: (1) implication of the airplane for society, (2) aircraft structures, (3) aerodynamics, (4) Civil Air Regulations, (5) power plants, (6) meteorology, (7) air navigation.

But more advanced and far-seeing than this is the recommendation that actual flight experience be made an integral part of the laboratory side of this course.

"Flight experience is the most dynamic part of aviation education," declares the committee, suggesting that "approximately four hours of flight experience be offered to every boy and girl in the aero-

EVERY HELICOPTER RECORD BROKEN.. *with Franklin* POWER

ON MARCH 2, 1944, the Army's latest helicopter, the Sikorsky XR-6, powered by a 245 horsepower Franklin engine, flew non-stop from Washington, D. C. to Patterson Field, Dayton, Ohio. With Col. H. F. Gregory at the controls, this flight unofficially broke every existing helicopter record.

A new distance record was established—387 miles, non-stop. The XR-6 remained in the air 4 hours and 55 minutes—a new endurance record. It flew the Alleghanies at 5000 feet, carrying pilot and passenger—higher than any helicopter ever before had flown with such a load. Ground speed for the flight averaged approximately 80 m.p.h. —new record cross-country time for a helicopter—made despite headwinds from 10 to 30 m.p.h.

Thus the XR-6 dramatically proved itself a practical flying machine, definitely out of the purely experimental stage. And thus another string of "firsts" was added to the long series already held by Franklin engines in the realm of power for flight.

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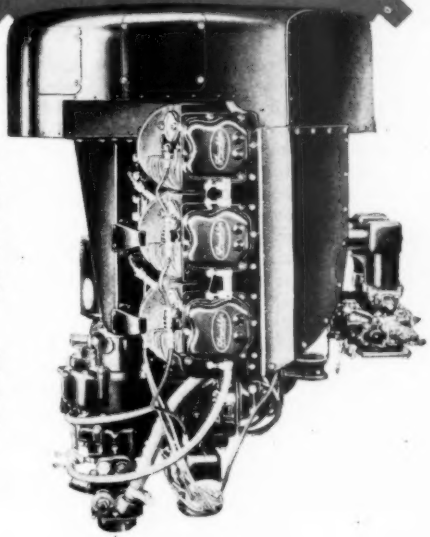

FRANKLIN ENGINE 6ACV-405, powerplant for the Army's newest helicopter, the Sikorsky XR-6, shown above.

Franklin
FINE AIRCRAFT ENGINES

nautics class . . . Laboratory work in an airplane will motivate the learning of scientfic principles throughout the aeronautics course. Personal flight experience should also make it easier for students to acquire an understanding of the social, political, and economic implications of the Air Age."

In short, the public schools have an obligation to give all young Americans the "feel" of the air. And there is only one way to do that—which is to get them into the air.

The schools themselves are not to teach flying. Rather, they are to use existing facilities in the local flight schools "authorized by the Civil Aeronautics Administration to offer civilian flight instruction . . Their instructors have been certified and their airplanes and other equipment approved for such instruction after careful inspection by the Civil Aeronautics Administration. This system of Civilian Pilot Training flight schools has been highly successful in the training of many thousands of pilots since 1939."

The committee recommends that each school board, upon recommendation of the administrative officials of the school, make a contract with an approved flight school "to give four hours of flight experience to each qualified high-school aeronautics student . . . in a light airplane equipped with dual controls." Such a contract should be similar to that used in the original CPT program.

"Financial support of the suggested type of laboratory experience," the committee report emphasizes, "is a legitimate use for school funds. Until such time as school boards have an opportunity to include the proposed expenditures in their yearly budgets, student activity associations, service clubs, and other groups will be willing to give some financial assistance."

Finally, on the college level, the committee brings forward a number of constructive recommendations to make aviation education in Wisconsin a highly integrated program, including acceptance of high school aeronautics as an elective science for college entrance; flight scholarships to enable persons of high school age to qualify for their private pilot's license; "out-of-school youths should be included along with high school graduates, particularly in centers conducted by the extension division of the state university;" courses for training high school aeronautics teachers and those offering other aviation material in the elementary and secondary schools; conferences to bring together teachers and aviation technicians; library service of visual aids, laboratory equipment, and printed materials for exhibit and classroom reference purposes; courses in education of aeronautical engineers; courses for training airport and airline managers, hostesses, traffic controllers, and ground, flight, and mechanics instructors for colleges and flight schools.

Nor is this the only such broad and comprehensive plan that has grown out of the CAA aviation education program. Illinois has evolved a plan to fit its particular needs: it is now on the press. Connecticut, Colorado, and California are working along similar lines and will soon have a report to make.

Here at last is the teamwork between civil aviation and public education that so many have long desired. The basis of all air power, both military and commercial, is a sound civilian aviation structure. It must be supported by the widest possible public participation—of young and old, in all walks of life. The CAA and the Wisconsin Plan point the way. END

How We Beat the Zero

(*Continued from page 29*)

tle conception of defensive teamwork as we know it now. The divisions usually flew as a string of four planes manipulated by the squadron leader. Their standard defensive tactic was for the leader to turn back and shoot any attacking fighter off the tail of the last plane in line—the point where the enemy usually struck. This was a bit tough on "tail-end Charlie," we discovered in the Pacific. He had a way of not coming back.

Despite the combat reports we kept getting in the first few months of the war, most of us still believed that in a dog fight we could knock down anything the Japs brought out. We didn't really get the bad news until they jumped us in the Battle of the Coral Sea.

I got mixed up with three Zeros at Coral Sea. I was one of a pitifully small escort of four *Wildcats* convoying a squadron of torpedo planes in an attack on the Jap task force. Just as antiaircraft fire from the Jap ships began to rock our planes, I looked up to see three Zeros high above in perfect position to peel off and dive on one E. Scott McCuskey.

I turned into the first attacker as he dropped at me. But my slow *Wildcat* couldn't bring me about to face him, so I had to sit there and watch him open fire. A shock like electricity went through my body as his smoking tracers approached How lazily they moved.

But the oncoming tracers began to drop astern; my attacker had underled me. Immediately, the second Zero came screaming at me but he, too, proved to be a poor marksman. At almost the same instant I saw the first Zero pull up in front of me in flames, shot down by a team-mate, Billy Woollen, as the Jap dived past me and pulled up for another attack. My second attacker made the tactical error of pulling up in front of me, and as he did I was able to bring my guns to bear. It was my first Zero!

In pulling up to shoot, I lost speed and the third Zero made a run on me. I rolled into a cloud and climbed for altitude. As I came out, I found the Zero and closed in on him for a shot, but he spotted me and pulled into a tight loop which I was unable to follow because of the superior maneuverability of his plane. So I ducked back into the cloud just as his tracer ripped my tail.

Coming out once more I nosed my *Wildcat* over and dived straight down to the water where I was safe from overhead runs, since my attacker would only have gone into the drink. Then I zigzagged rapidly from side to side to duck his tracer fire as he hung on my tail. Finally I reached a nearby rain squall.

My inglorious performance on this occasion illustrates the first step in the tactics we adopted against the Zeros. We simply dived away from them and ran away, taking advantage of the one performance superiority of our planes, superior speed and control in a dive.

Low on gas, I had to take the nearest landing spot, which turned out to be the *Lexington*. When she was hit I couldn't fly off and had to abandon ship with her crew.

Soon I was back on the *York* bound for Pearl Harbor. There we got new planes and 18 of us in Fighting 42 joined forces with Fighting Three under Comdr. Jimmy Thach, to form a new *Yorktown* squadron.

At the Battle of Midway I had shot down three dive bombers and damaged three others when two of us broke up the first wave of attackers, but four of them fouled up the *York's* decks so she couldn't land us for gas and ammunition.

The whole situation brought home the need for more fighters, as well as planes with greater range and ammunition capacity. Ducking into clouds, diving and running, we ganged up in desperate little groups to fight our way back through the swarming Zeros. I had to land aboard the *Enterprise*. As plane after plane came back shot full of holes, punch-drunk and weary pilots stumbled into ready rooms and stood looking at each other in stunned silence.

The boys in all the air groups were pretty low. Though we'd turned back the Japs at Coral and again at Midway, we'd lost two carriers and a lot of airplanes. Torpedo Eight was gone and some of the bombing squadrons were missing half their men. Moreover, in these two battles the fighters learned first hand that the Zeros could fly faster, outclimb and outmaneuver us.

After Midway, fighters all over the fleet went into huddles with their squadron leaders—such men as Comdr. Jimmy Flatley, Comdr. Jimmy Thach, and Comdr. Charles Fenton. We got our heads together on ways of bringing against the Zeros the best assets of our training and our planes.

The day of the dogfight was over for us because the Japs could run circles around us in single combat. Our first emergency defense was to dive for the water and "jink" away, skidding out of the path of the pursuers' tracer. But running away got tiresome; so we ganged

(*Continued on page 98*)

U. S. Army Air Forces Photo of B-29 Super-Fortress

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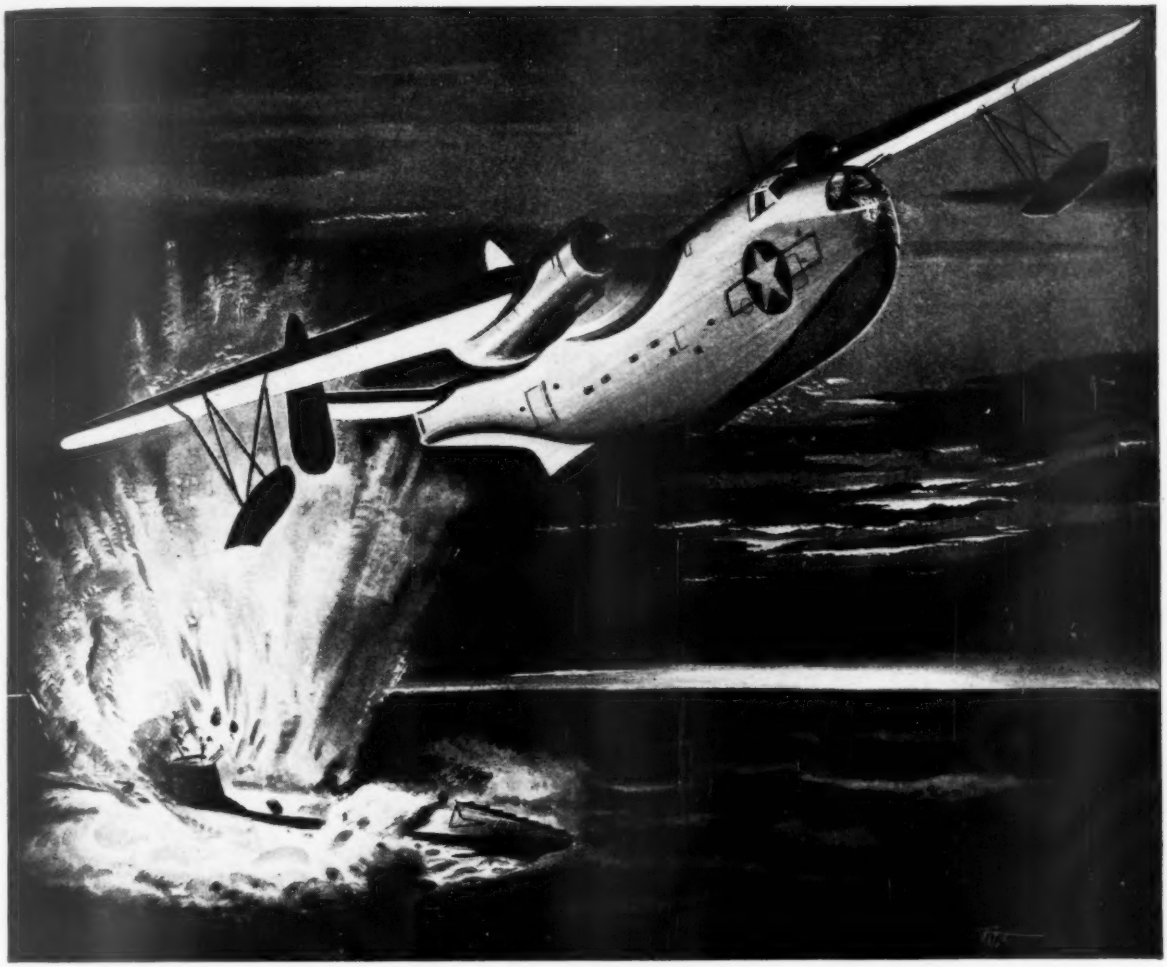

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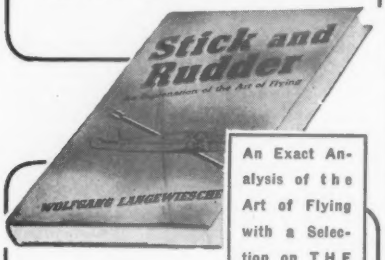

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(*Continued from page* 94)

up on them. In mass melees, we'd all stick together and buzz around "like bees in a bottle," to use the words of Comdr. Roy Simpler, formerly skipper of Fighting Five. We'd just swarm around, with every pilot getting the Zero on someone else's tail. If you got stuck with one, the idea was to swing around in front of another *Wildcat* so your pal could shoot him off. It took plenty of self-control to let some Jap pepper away at your own tail while you went after the Zero on your wingman's tail.

This tactic was successful because the Zero couldn't take two seconds fire from a *Wildcat* while a *Wildcat* could take sometimes as high as 15 minutes fire from a Zero.

Our practice of swinging around in front of another plane when a Zero got on our tail was a natural step in the evolution of the maneuver known as the Thach Weave, one of the greatest contributions ever made to combat tactics. Based on the common experience of many squadrons, the weave was interpreted and crystallized as a tactic by Commander Thach after the Battle of Midway. He spread the gospel to the other squadrons and then went back to operational training headquarters to work out and teach a whole new system of fighter tactics.

So much for the defensive. On the offense, we always maneuvered for altitude, bearing down on the Japs in high speed runs, with our six .50-caliber machine guns. We hit and kept going, and then jockeyed into position for another run.

We had the Japs with our marksmanship, a product of 20 years of Navy stress on gunnery. Highly trained in deflection shooting, we did not have to depend, like the enemy, on a straight shot from fore or aft, but fired away from all angles abeam, leading our Nip targets like clay pigeons. Our little *Wildcat*, with her armor and leak-proof tanks, took everything the Japs could deal out and began to pile up a three to one ratio on the enemy.

It was apparent, however, that with the *Wildcat* we could fight only a defensive fight. Pilots were crying for a plane with more speed, climb and range —something that would take us out farther and carry a heavier load. Their plea was answered by the *Hellcat* and the *Corsair*, which embody the combined experience of flyers since Pearl Harbor. As a carrier-based pilot, I have been interested principally in the *Hellcat*, since this is the plane particularly adapted to carrier use.

While the *Hellcat* was in production, most of us who had been in Fighting 42 since Pearl Harbor were sent back to the states to pass on our experience to the new flyers so urgently needed. We had set up what I believe to be the high mark for planes shot down in those early days of the war, with a score of 54 Japs to only four of our own men. Seven of the Japs were mine, plus several assists and probables. Exhausted and jumpy from long combat duty, we boarded a ship for San Francisco, long overdue for a rest.

After a year of training Naval aviators at Jacksonville, Commander Collins invited me to join his squadron as tactical officer. Then began one of the stiffest workouts in my experience. At Norfolk during June, July and August, we poured on the heat from 7 a.m. to 7 p.m.—seven days a week. Besides their previous flying as instructors, most of the new pilots in our squadron had over 200 hours in *Hellcats* before we ever hit the decks of our carrier. The *Hellcat Squadron*, as it was called, shaped up rapidly into a polished combat machine.

Though it had the jump in flying experience, the squadron was to see many more hundreds of hours in the air before it went out to combat, consisting for the most part of intensive gunnery training. Navy squadrons usually have around 400 hours of flying together before they hit combat and this extensive practice (as a squadron!) is one secret of the fantastic combat ratios we are running up in the Pacific—ratios often as high as 10 to one but averaging more than four to one.

Having long since dropped the three-plane formation, our fighters now work in two-plane teams, the teammates flying abreast of each other to form a division of four.

To protect ourselves and the planes under escort from lurking Zeros, we fighters must keep a flawless lookout every minute we are in the air. Our present flight formation is very effective. Flying opposite each other, the leader and the wingman of each section watch in a semi-circle—each looking in the direction of the other—and there is no part of the surface, horizon or sky that is not under constant observation.

Though we fly the *Hellcat* and the *Corsair*, vastly superior to our old planes in speed, maneuverability and range, the backbone of our tactics is the same protective maneuver we developed in our *Wildcats*—the Thach Weave.

Simple in theory, the maneuver is difficult in practice and we really need those hundreds of hours of team practice to stick together continuously through a long melee and maneuver violently enough to bring our guns to bear on the enemy without having his bear on us. If one plane in a section is shot down, the remaining plane flies as a section. If one section is lost, the remaining section splits and conducts the same tactics. Thus every man in the division must be able to act as a section leader.

So much for the defense. Going on the offensive, the three primary jobs of the fighters are:

1. Escorting bombers and torpedo planes.
2. Shooting down attacking bombers and torpedo planes.
3. Intercepting enemy fighters.
4. Strafing enemy ships and shore installations.

On escort, it is the unvarying duty of the fighters to stay with their charges and not allow themselves to be drawn off in mass dogfights with enemy interceptors during which other enemy planes

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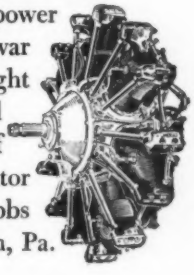

JACOBS . Pottstown, Pa.

might swoop down on their own bombers. When under enemy attack, the escorting fighter divisions weave back and forth over the bombers, the teams mutually protecting each other against attack from any quarter even though the enemy may have the altitude advantage.

Pilots are drilled endlessly on fundamental approaches, whether from overhead, aft, side, or below, but it is teamwork which makes these approaches count in the battle tally. Just as fighters work in teams on the defense, so they operate on the offense. The minimum team is two planes, although whole divisions team up under some circumstances.

"In modern aerial warfare," says the Navy fighter manual, "the lone eagle is the dead duck."

The target of the two-plane team is one enemy airplane. The two teammates gang up on the Zero and keep him under control until one or both fighters can shoot him out of the air. Larger units, such as the section or the division, may team up to attack an enemy formation; this is the usual routine when there is an enemy dive bomber squadron to be cut down. One unit feints while the other jabs, and the two vary their punches, always striking from the point of greatest vulnerability.

I've tried to give some idea of what teamwork really means to us in aerial combat. One of our best assets in beating the Japs in the air has been the skill of the average American boy in team play and his ability to make quick individual decisions. But teamwork really gets serious when you're playing for keeps. And no one knows what practice is who hasn't flown fighter maneuvers. We've gone through our tactics until every movement is almost automatic. But this isn't enough; you've got to know just where your teammates are at all times.

Following the counsel of one of my former carrier skippers, Adm. Thomas Sprague, USN, whose motto was "Never practice your mistakes," we've studied the errors of hundreds of pilots who came to grief. Of course some get shot down without making any mistakes.

We have often been called a "hot" squadron, but it's not a good word. It smacks too much of the foolhardy. We're all working to return to some particular slice of the new world for which we're fighting. Eddie Osborn, who holds jam sessions at night around the carrier's special electric organ, wants to play the organ at Radio City; "Gus" Gustafson, former All-American football star from the University of Pennsylvania, would be another Knute Rockne. And I am going to run for a seat in Congress from the old home state of Arkansas and raise a big family of McCuskeys. END

World CPTP?

(*Continued from page* 28)

Predictions in Washington are that the day is not too far distant when, as a result of the new program, the present number of trainees will be multiplied by from 10 to 20 or more. Aviation training of South Americans has been going on here in an expanding ratio for a number of years, but the new program will mark the first time since the war began that the work will be projected world-wide. It also marks a practical climax to negotiations begun early in February, when Mr. Berle asked Mr. Burden to review the record on aviation education of foreigners and recommend future activities in the field. At that time, Mr. Burden said:

"It is my feeling that an intelligent long-range program for making United States civil aviation techniques available to foreign nations can be an enormously important factor in strengthening the world position of United States aviation. It should also be of distinct value in improving our relations with other countries."

He also made three tentative recommendations upon which subsequent discussions were based—that the new program provide (1) for missions by U. S. aviation experts to foreign countries, (2) for the training of official foreign government representatives here, and (3) for the training of foreign private citizens in the U. S. These points all were expanded at meetings which followed among Governmental, industrial and business officials during late winter and spring.

As the program shapes up, it will be one of the most practical in the educational field, and will closely follow work already successfully completed in South America.

Missions—far from being the gold-braid junkets that the word sometimes connotes—will consist of long-term visits to foreign countries by American aviation experts, and an obligation to pass their knowledge along to executives with whom they work. Typical is the mission last November by C. J. Tippett of CAA, who went to Brazil to teach airline pilots, government supervisors, inspectors and flight instructors safety and efficiency techniques developed in the United States for scheduled and non-scheduled flying. Tippett also was responsible for helping keep flight operations in the country on an efficient basis while his educational work went forward.

Similarly, foreign government executives brought here for training will find a work schedule waiting to tax them to their capacities. An example is the mission of Senhor Paulo Sampaio of the Brazilian Air Ministry in 1942. Senhor Sampaio put in a 10-hour day studying the CAA almost from the time he arrived until he returned home, where he has since become president of Panair do Brazil.

Indications are that aviation training for foreign private citizens will be expanded from the current program, which began in the spring of 1941 under Mr. Stanton, then Deputy Administrator of CAA. More than $730,000 was spent for this work for the year ended July 1, and $800,000 has been requested for continuing the work through June of 1945. The money will be turned over to CAA from State Department's budget allocated for this purpose.

As the program develops on a world-wide scale, however, a major and significant change in the organizational set-up is anticipated. This concerns the Inter-American Training Administration under Mr. Hanson. Since Mr. Rockefeller's CIAA is concerned only with South American problems it would be impossible for CIAA to handle a world-wide student servicing organization, as the Training Administration has been handling it in South America for the Rockefeller group.

In addition to expanding the program to include the world, it will have other new features. Industry and business will have increasing participation, both in choosing candidates and in training them after they get here for foreign service in a specific concern. Training involving a specific man picked by a specific industry will be paid for by industry rather than by the Government. Furthermore, the system for bringing students to this country, acclimatizing them, and returning them to their homes will be run, not by a Government-financed agency as at Mr. Hanson's present Inter-American Training Administration, but by a private, non-profit corporation.

Plans for this also are crystallizing as the result of meetings which began last October at the annual convention of the National Foreign Trade Council. At that time, Nelson Rockefeller asked the council to survey its membership on the possibility of making the IATA world-wide in scope and private-non-profit and self-supporting in operation. E. P. Thomas, president of the National Foreign Trade Council, launched the survey through its Foreign Trade Education Committee of which James S. Carson is chairman. The recommendations, reported this spring, unanimously favored establishing a world-wide training program clearing through a non-profit coordinating unit.

The new world-wide unit will be expanded from Mr. Hanson's present IATA which, in the words of Nelson Rockefeller, was "instituted as a small industrial project. In some two years of operation it has developed into an organization serving a training organization of approximately $1,000,000 gross business annually."

The training administration will, as in the past, handle all types of training, aviation being but one facet of its work. Other training already has included such widely differing projects as railroad administration and liquor fermentation. More than 50 projects have been completed since it was organized under CIAA auspices. A total of some 1,700 individual cases have been processed, approximately

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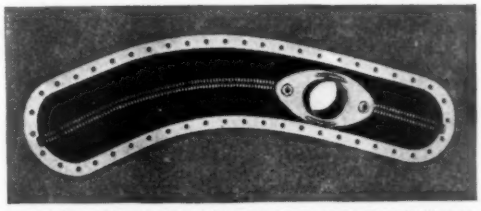

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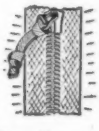

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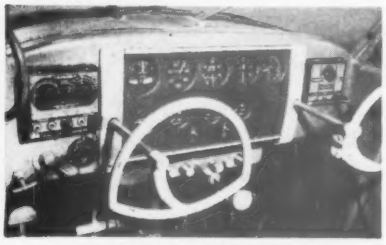

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1,000 of them resulting in scholarships to this country. More than 25 per cent of these have been trained at the expense of industry, a percentage which is expected to increase as industrial and business participation becomes felt, especially in post-war days when industry will be able to turn its attention more to peacetime projects.

To insure the double-barreled purpose of the program—teaching students American methods and at the same time building international good-will—Mr. Hanson and his associates will welcome each student on his arrival to this country. They will work out for him the myriad details involved in his coming, acclimatize him by checking his knowledge of English (which will be improved when necessary), give him a brief course in American ways and American Government as pertaining to his specially chosen educational field.

In all, they will send him on his way to his U. S. "school" thoroughly prepared to begin his course under the most friendly circumstances.

As formerly, the student will regularly report progress and field workers will make first-hand surveys on how he is getting along, socially as well as in his work. The administration will also speed him on his way back to his home. Says Mr. Hanson:

"The objectives of the work are, specifically, to give a student things that he can take home and use in his own environment. This will benefit the company teaching him and will benefit the student. But there are other and perhaps more important advantages to the nation as a whole. Take South America, for example. We are not a colonizing people. When the war began, there were perhaps no more than 55,000 U. S. citizens in South America. But there were some 10,000,000 first- and second-generation Ax's residents. Native-born students coming here, living and working in a friendly atmosphere and going home to preach goodwill to this country, will be invaluable in our international relationships and will go a long way toward preventing future infiltration in traditionally friendly countries by enemies of the democratic way of life."

Applied specifically to the aviation industry, the new program will mean a number of things. Most immediate is that pilot training—particularly of South Americans—is expected to go forward with possible modifications from time to time, as in the past. Indications are that future training programs will be enlarged and will include nationals from all parts of the globe. Other students will begin to turn up in U. S. aircraft factories, on airlines and airports. Similarly, U. S. aviation missions will begin to appear at widespread points around the globe. And as time goes by, the men who have come here from abroad to study will go home to put their learning to good use wherever the airplane flies. The ultimate idealized promise of the program is that there will be hardly a place where an American business man, industrialist, lightplane, tourist or transport passenger can land without meeting an old grad of the program, familiar with American equipment and American efficiency and safety methods, full of good-will toward U. S. products and toward fellow-students from the "campus"—the United States of America.

Any way you look at it—as a symbol of how Government and business can work together, as a harbinger of international friendliness, or as a strictly mutual-benefit proposition—the new world-wide program shows promise of being as outstanding in world affairs as were the Rhodes Scholarships in their heyday. Some feel that they will have even more widespread influence, since they will reach men on the practical, operational level of world affairs. Among these last are students who have written to inquire about scholarships from Iceland, Turkey, China and South Africa, with scores of other countries to be heard from. French, Dutch and Russians, to name a few, already have sampled parallel programs under military auspices. The CAA, besides its South American work, has entertained missions from Canada, England, and Australia. South American graduates who have gone home to work, write glowing accounts of their successes—accounts, not incidentally, implicit with good-will for the United States. Only the future can show how far and how brilliantly the work can progress. Today, as it enters its world-wide phase, everyone is unanimous on one thing: the future is bright. END

What Was Wrong with Private Flying?

(*Continued from page* 31)

gerous. They also show that many who started to fly made their solo flights and then quit; and that those few who bought airplanes kept them an average of only 3.44 years and then got rid of them.

That is a dismal picture. And, since history does repeat itself, we might profitably go back and read a little history on these important points.

In 1927-29, a three-place, open Waco biplane, powered with a 90-h.p. war surplus engine, sold for $2,385. Hangar rent was $30 a month. A top overhaul (clean carbon, grind valves, etc.) cost about $50. A lower wing panel cost $250 to replace.

Later, we had better planes. The Monocoupe was better looking, faster, had a 65- or 90-h.p. air-cooled engine. It sold for $3,884. The company had an interesting sales scheme. They would sell the owner a kit for a complete engine overhaul for $100. It consisted mainly of all bushings in the engine which were subject to wear, 10 valves, 10 valve springs, five pistons and the necessary rings. The kit was probably sold at cost but it is an indication of what that cost was.

Today Geisse and Williams present better cost figures.

They consider a plane that represents the largest registry in the private field, a two-place, single-engined cabin monoplane powered by a motor of less than 75 h.p.—the only type sold in quantity

GI's ... by proxy

Whether it's forty degrees below zero in Alaska or one hundred and seventy in the sun at Iran, the technical representatives of Bell Aircraft's field service staff help keep thousands of Airacobras flying... and fighting in the far corners of the world.

The first technical mission sent to Russia by an American manufacturer consisted of Bell Aircraft servicemen and engineers. These men gave valuable technical information to the Red Air Force to assist their engineering officers and ground crews in servicing and maintaining the thousands of Bell fighter planes on the Eastern front. In return they brought back first hand knowledge of Airacobras in action which has aided us in producing even more effective air weapons.

Theirs is a dangerous life. They are civilian G I's who play an important part in helping the Army Air Forces and our Allies to keep 'em flying. Here in America, they serve nine commands of the Army Air Forces—living a soldier's life on the California desert or in the swamps of Florida—in order to learn how to work under actual war conditions.

Some of these Bell Servicemen are now studying the new powerful fighter plane coming from our Niagara Frontier Division. Some are giving their entire attention to the flexible machine gun mounts made by the Bell Ordnance Division. Others are taking a special course on America's first jet propelled plane designed and built by Bell Aircraft —as spectacular in its way as the B-29 Super-fortresses of which Bell Aircraft is one of the producers in its bomber plant at Marietta, Ga.

And when the new Bell helicopter becomes available for general use, the service department will add this latest Bell Aircraft development to its activities. © Bell Aircraft Corporation.

MEMBER AIRCRAFT WAR PRODUCTION COUNCIL—EAST COAST INC.

BELL *Aircraft*

PACEMAKER OF AVIATION PROGRESS

Niagara Frontier Division, Buffalo and Niagara Falls, N. Y.—Ordnance Division, Burlington, Vt.—Georgia Division, Marietta, Ga.

BUY WAR BONDS AND SPEED VICTORY

THAT OUR COUNTRY MIGHT *Out-Devise* THE ENEMY

Small example of a BIG PROGRAM inaugurated at the outset of war

By developing an ammunition box of phenolic cloth laminate to replace one of stainless steel, Curtiss engineers simultaneously accomplished a saving of critical metal, economy of weight and a reduction in cost. Three important advantages accruing from the change of a single part!

When the war started, Curtiss-Wright instituted its own program of strategic material savings. Today many of the then critical materials are no longer on the list, but the program has been broadened to include the whole field of material research.

Lighter, stronger materials have been developed and many more are on the horizon. Not only will they increase the speed and effectiveness of our fighting aircraft but, in days to come, will make possible greater payloads for the Curtiss Transports that will fly the skies of Peace. Curtiss-Wright Corporation, Airplane Division, Buffalo, Columbus, St. Louis, Louisville.

Another Contribution of

Curtiss-Wright

Toward Winning This War

Member, Aircraft War Production Council, East Coast, Inc.

during the 1933-37 period. This plane sold for about $2,000.

Thus it cost $2,000 to get started as a private owner, plus $100 to $300 for flight instruction. From there on, how much did it cost?

In a speech at Detroit, Mich., in April, Geisse gave one rough yardstick for figuring cost of operating either high or low-priced planes or automobiles. It costs between 40 per cent and 60 per cent of the purchase price annually. Here are the figures on three bases, a meager, an average and an unusual number of hours of flying per year:

	100 Hours	200 Hours	1,000 Hours
Direct Operating Cost	$ 177	$ 354	$1,770
Rent	180	180	180
Depreciation	200	200	200
Hull Insurance	310	310	310
Liability and Property Damage	148	148	148
Total Annual Cost	$1,015	$1,192	$2,608
Cost per Hour of Flying	$10.15	$ 5.96	$ 2.61

The high cost of insurance is immediately apparent. Without hull and liability insurance, the owner could fly 100 hours a year for $5.57 an hour instead of $10.15, and 200 hours a year for $3.67 an hour, instead of $5.96. Insurance rates reflect risk, of course, and this brings up the question of danger. The additional cost of life insurance is not calculated in the figures listed above.

General life insurance, where the applicant is not currently engaged in aviation, is usually issued without any restriction of coverage. Consequently, travel by air over the scheduled airlines is fully covered and even a more active interest, which develops after the policy has been issued, is fully covered. Once an unrestricted policy is issued on a bona fide application, the insurance company cannot impose restrictions. Prospective private plane owners ought to get out their insurance policies, however, and read all the fine print.

But in cases where the applicant for insurance is likely to become active in aviation either as a passenger or otherwise, the companies feel obliged to make a more accurate appraisal of the risks and an aviation rider limiting the company's liability to the reserve in the policy is often inserted.

The rates go up if the applicant plans to fly his own plane. As a private flyer before the war, expecting to fly about 200 hours a year, your life insurance premium would have been upped about $15 per $1,000 and $25,000 coverage would be the most you could buy. Thus, flying your own plane 200 hours a year with $25,000 insurance, the policy would have cost you $2 an hour of flying time. There were accident policies available at the rate of about $10 per $1,000.

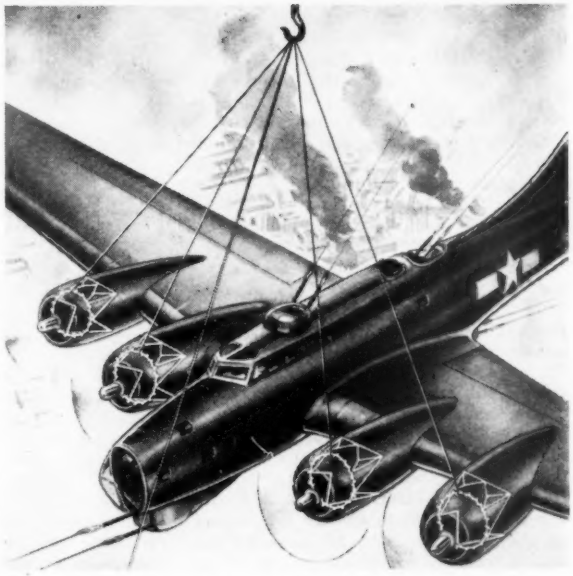
Incidentally, that is a bigger-than-average figure of annual flying time. Two hundred hours would represent about 20,000 miles of travel. The average private owner flew 10,000 miles a year up to 1937, and 16,000 a year in 1940. Probably the average will be higher in post-war years.

Hangar rates just before the war averaged $25 a month for the average small plane, and hangar space was so scarce that a dolly was constructed so that planes could be tipped up on their noses, and 30 crowded into a hangar which would hold only 20 sitting normally. However, the five principal manufacturers of this type of plane told Geisse and Williams that 50 per cent of their products have not been kept in hangars in the past and they say the increased cost of maintenance resulting therefrom is less than the cost of hangaring.

Now, as to danger. The Burden report rather pessimistically points out: "There is no evidence that any essential changes will be made in underwriting practices by the life insurance companies after the war until flying has developed further. Any liberalization in attitude toward post-war flying because of reduced hazards brought about by introduction of safety features in the airplane itself will probably also have to wait on several years experience."

As far as instruction goes, the Civilian Pilot Training Program has showed that it can be safe. Daily, however, the Civil Aeronautics Board publishes reports of typical accidents and year after year, the same facts stand out. Accidents are caused by the pilot. So few are due to the airplane itself—that is, to structural failure—as to be negligible. Weather is dangerous but careful pilots need never be killed by weather.

(*Continued on page* 106)



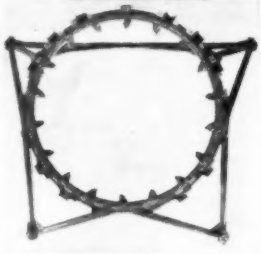
The "Fortress" has a

SKYHOOK

Too!

A dove on the ground, the "Fort" is only as swift and ferocious as an eagle when air-borne.

Skylark's precision-engineered steel tube motor mounts hold secure the four massive engines giving this deadly sky giant flying power. Thus, by knowledge of forging and precision welding of motor mounts, bomb racks, control systems, and other vital airplane parts, Skylark's craftsmanship is helping American Air-Borne Craft to Victory today. Consult Skylark on problems of tooling, fabrication, assembly, processing and design.



ENGINE MOUNT

From the raw tubing, to the finished mount, no precaution is too tedious, no method of checking inconsequential . . . dependability is the byword at Skylark.

SKYLARK'S CRAFTSMANSHIP TOMORROW

Plan now to use Skylark's skilled, experienced operators tomorrow, when "bombers" become transports, and "pursuits" become pleasure craft.

SKYLARK

AIRPLANE PARTS CRAFTSMEN

SINCE 1934

Skylark Manufacturing Co., Inc., Venice, Calif.

In the fiscal year ended June 30, 1942, the CPT made the astounding record of 10,000,000 miles per fatality, and over a period of three years the record was 6,000,000 miles flown per fatality. This, of course, was instruction flying.

Generally it is true that regardless of the faults or shortcomings which the private plane may have had in the years prior to the war, it was not a dangerous vehicle per se. Like the automobile, its mechanical imperfections may have contributed somewhat to the accident totals but by and large the human element caused the accidents that killed. Improvement of the plane so that it requires less of human skill and judgment will improve the safety record, but no transportation vehicle will ever be foolproof.

Why have so few people bought airplanes? Why, after they bought them, did they keep them less than four years and then get rid of them?

Geisse and Williams include a CAA survey made in 1940 to answer the second question, and it indirectly answers the first as well.

Because you must first know how to fly to be a private owner-flyer, the survey first looked into the student pilot situation.

Only 15 per cent of those who obtained student permits went on to obtain their private pilot's licenses in the years 1933 to 1938. To find out why, a sampling of these ex-students was made.

Two facts stand out in the answers: Flying was too expensive and flying lacked utility.

In Mr. Geisse's Detroit speech mentioned above, he cites the following survey of private owners to indicate reasons why private flyers discontinued ownership:

Expense greater than anticipated	30.3 per cent
Change in financial status	19.7 per cent
Too much time to and from airports	8.9 per cent
Not as useful as expected	6.8 per cent
Desired flying time procured	5.1 per cent
Change in family status	5.0 per cent
Too much regulation	4.2 per cent
Pleasure less than anticipated	3.0 per cent
Family objections	2.5 per cent
Too much time to keep in practice	2.4 per cent
Miscellaneous	12.1 per cent
	100.0 per cent

Now, why did owners not keep their planes? Surprisingly, for the same reasons that induced their less determined brothers to give up flying: too expensive and not useful enough.

Some bought and flew their planes to build up time and get flying experience for their prospective aviation careers. Disregarding these individuals, the survey discovered that 50 per cent of the others bought their planes for local use, 40 per cent for cross-country flying, and 10 per cent gave business as their reason.

For the period 1931 through 1939:

Eighty-three per cent of the owners have a mean period of ownership of less than 2.5 years.

Fifty per cent continued ownership of their aircraft for less than two years.

Thirty-three per cent continued for one year.

Assuming that the maximum time a person could own and use a plane would be 30 years, the figure for automobile ownership, these figures were extrapolated by Geisse, and the average length of ownership was under four years. A pilot waggishly pointed out that he didn't believe the figures, because he figured the owner had kept his plane one year and then tried for three years before he could sell it.

So, in this richest of all countries, expense of the airplane, and expense of the flying school, has deterred 60 per cent of those who would fly, and at least half of those who would *own and fly* their individual planes. Here again is the familiar vicious circle: high prices restrict quantity production, and small quantity production causes high prices. The report's other figures, those referring to a lack of utility of the airplane, indicate one weak point at which the circle can be attacked. A useful plane would sell in such large numbers that manufacturing costs could be reduced.

Without being asked, owners who sold their planes offered another important reason. One in 25 said there were too many regulations around private flying. They volunteered this information without being asked, a circumstance regarded as significant by Geisse. END

Homing by Radio

(*Continued from page* 59)

Homing is much more valuable than these simple examples indicate. There are times in domestic flight when the pilot receives instructions to land at an alternate airport because his scheduled landing field is closed on account of weather conditions. He may not know his position accurately nor can he listen for a radio range signal. He must immediately pick a path to the unscheduled airport. Again his ADF comes to the rescue. The pilot tunes in a station near the alternate field and guides the plane to it. In combat zones, all landing fields are alternates. After battle a plane's position is rarely known and, in the absence of this information, landings at fields other than the base airport are frequently made.

For long distance military and commercial transport there is even greater need for ADF than in homing. It is true that all methods of navigation are used to determine the plane's position on such flights. Whenever weather conditions permit the sextant is used to sight the stars or planets. But when an overcast prevents the use of the sextant it is a lifesaver to have an ADF and a good magnetic compass. How do these devices work for position finding?

First it is necessary to assume an imaginary straight line passing between the plane and a radio station when the plane is not headed toward the station. In Figure 7, the plane is headed 70° east of north, so the magnetic compass tells us. The ADF pointer reads 40°, indicating that the radio station is 40° to the right of

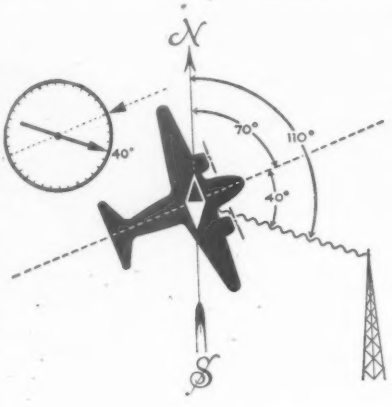


Figure 7.

the plane's heading. Therefore, the line through the radio station and the plane makes an angle of 110° to the right of north. This line, passing through the plane and a known point on the earth, is now drawn on a navigation chart with a Weems or Warner Aircraft Plotter. The operation is repeated, using another radio station, and the second line drawn on the chart. By extending these lines, the location of the plane is found at the point of intersection. For the sake of accuracy a third line is used, in the hope all three will intersect at one point.

To make the application specific, note in Figure 8 the three radio stations, La Guardia Radio, Washington Radio and Bellefonte Radio. In quick succession, at predetermined intervals, the pilot tunes in on each of the three stations, then, by using the imaginary line, determines the directions from the stations to the unknown position of the plane at the time the station were tuned in. Each line is then plotted on the chart. By extending these lines, the intersection is found to form a small triangle. The plane is in the

Figure 8.

center of the triangle. The whole procedure is completed in three minutes—and the plane is known to be over Columbia, Pa.

The advantage in speed with which a fix is obtained cannot be overestimated in air navigation. By celestial navigation a

(*Continued on page* 110)

A pencil of energy beamed like light

IF YOU'LL imagine an *invisible* searchlight beam, you'll have a good picture of how Klystron-generated radio waves can be directed into a narrow "pencil" of energy.

▶ This direction is accomplished by suitable reflectors. The beam of ultra-high-frequency waves travels in a straight line, and it can pierce fog, smoke, and clouds which would stop a light beam.

Sperry-developed Klystron tubes are used in many equipments now serving our Armed Forces. Later, *Klystronics* will open the door to the development of many ingenious peacetime devices.

▶ **Klystrons are now being produced in quantities, and certain types are available.**

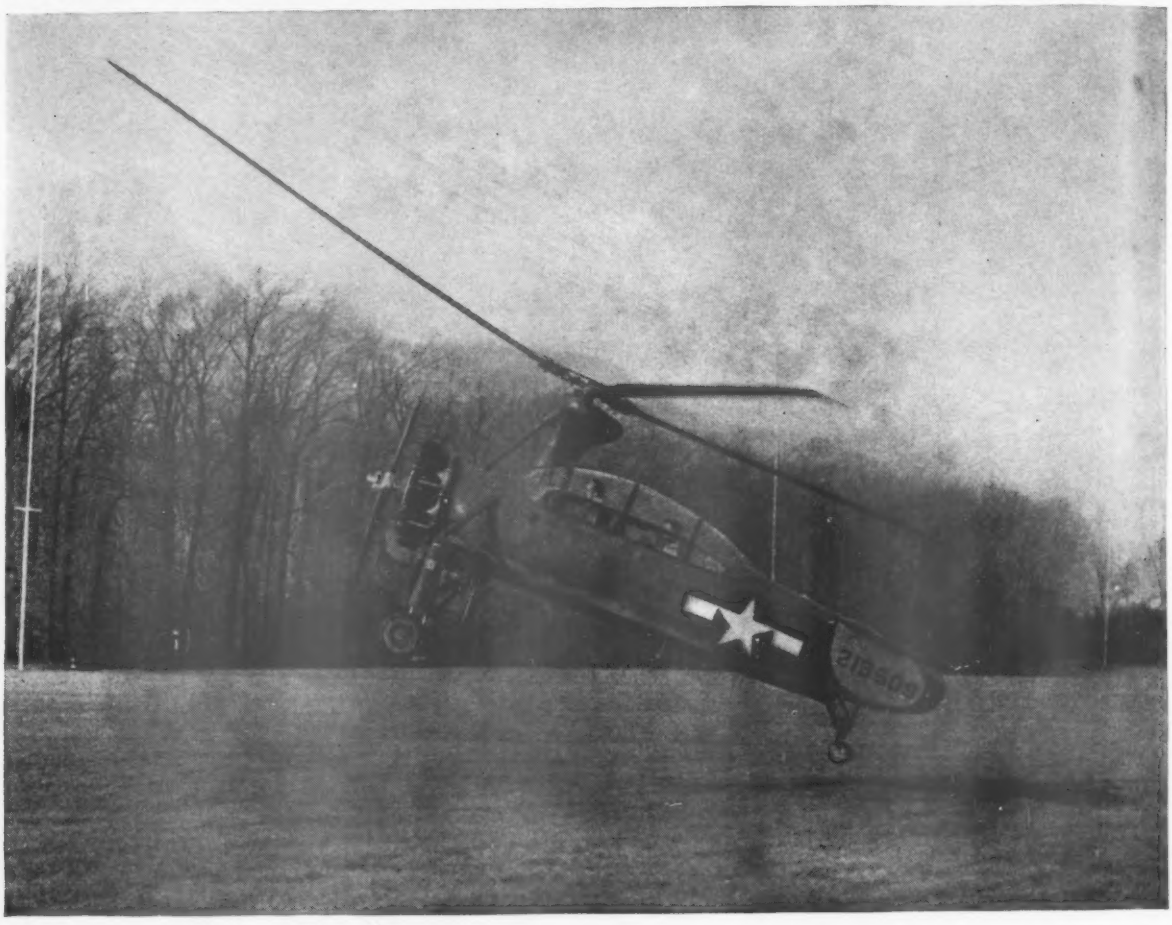
The name "KLYSTRON" is a registered trade-mark of the Sperry Gyroscope Company, Inc. Like many other Sperry devices, Klystrons are also being made during the emergency by other companies.

Sperry Gyroscope Company INC.

GREAT NECK, N. Y. • DIVISION OF THE SPERRY CORPORATION

GYROSCOPICS • ELECTRONICS • AUTOMATIC COMPUTATION • SERVO-MECHANISMS

★ NUMBER 8 IN A SERIES, TRACING FIFTEEN YEARS OF KELLETT AIRCRAFT HISTORY ★



Planning for Tomorrow

THE photograph above shows an earlier Kellett development, a military-type autogiro, undergoing tests by the Army Air Forces.

For many years, aeronautical engineers have strived to develop aircraft able to take off or land vertically on any kind of field or flat roof, and to climb handily over usual flight obstructions . . . aircraft that can cruise smoothly at satisfactory speeds, or hover motionless.

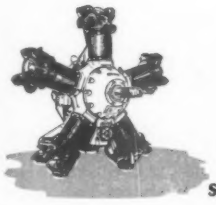
During the war, all available materials and manpower are required for military needs. But the growing Kellett engineering staff looks forward to peace, and the opportunity to focus its aeronautical design abilities on helicopter developments for a wide range of contributions to American progress.

Indications are that modern aircraft of the helicopter type will then save time and money in forestry service, ranching, dusting and spraying agricultural crops, patrolling and inspecting cross-country power lines and oil pipe lines, in prospecting—and many more everyday services. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

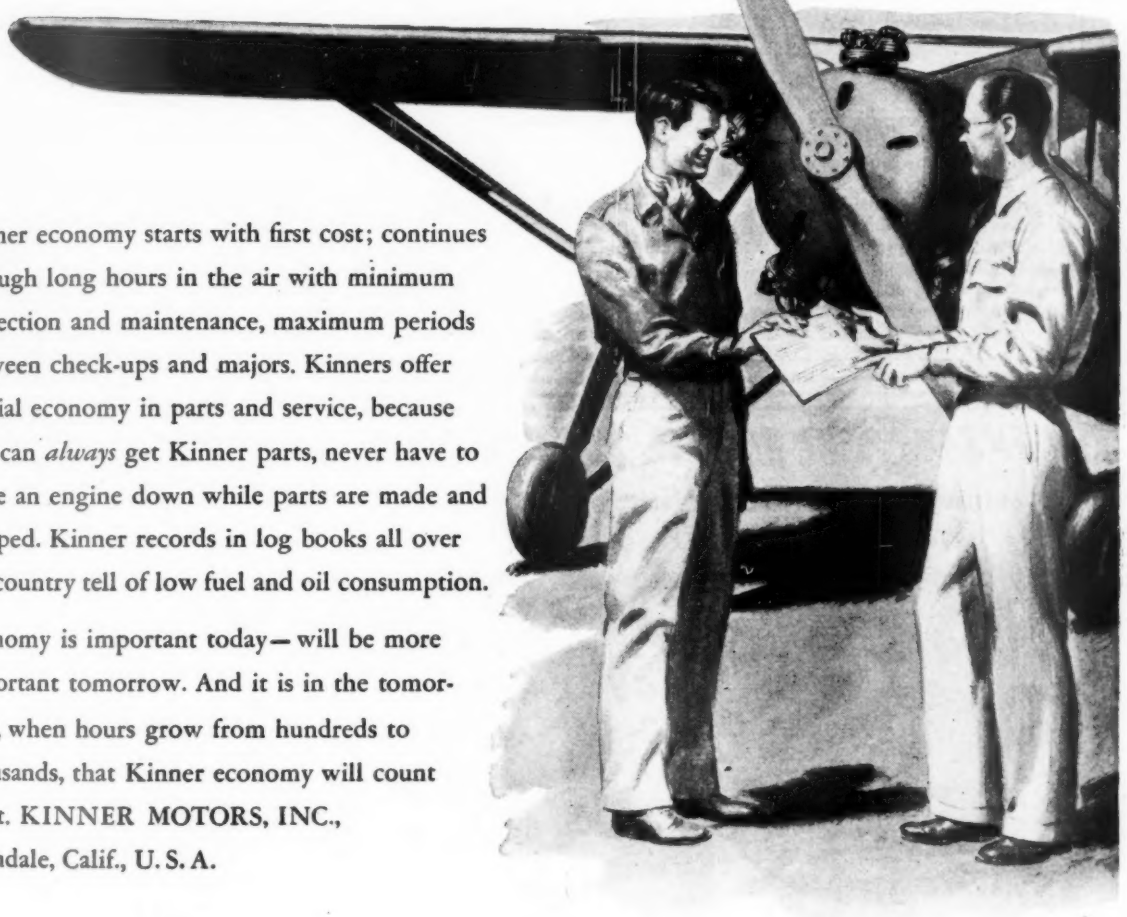
KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

It's the Hours between Majors that Count



Engine economy comes first when considering how to keep planes in the air. For, the time has arrived in civilian aviation when costs again assume importance, when savings must be realized. Kinner engines will answer the problem of low cost power, because Kinner has built economy into its engines for a quarter-century.



Kinner economy starts with first cost; continues through long hours in the air with minimum inspection and maintenance, maximum periods between check-ups and majors. Kinners offer special economy in parts and service, because you can *always* get Kinner parts, never have to leave an engine down while parts are made and shipped. Kinner records in log books all over the country tell of low fuel and oil consumption.

Economy is important today—will be more important tomorrow. And it is in the tomorrow, when hours grow from hundreds to thousands, that Kinner economy will count most. KINNER MOTORS, INC., Glendale, Calif., U. S. A.

BUY MORE WAR BONDS

Kinner

1919 — BUILDERS OF DEPENDABLE AIRCRAFT ENGINES FOR A QUARTER CENTURY — 1944

(*Continued from page 106*)

fix can rarely be found in less than eight minutes and at the speeds which planes are now making even five minutes is a lot of time. It would be misleading, however, to make unjustifiable claims for ADF. There are times when a celestial fix is more accurate than a radio fix. Navigators, however, have told the writer of occasions when, in spite of the accuracy of the celestial fix, they put more faith in their ADF. Then there are occasions when a celestial fix can be obtained although an ADF fix cannot. And the reverse is also true, as already observed.

Navigation of airplanes naturally attracts our interest but not to the exclusion of ships of the sea. It is true, ships at sea can weather storms or heave to, drift off course without too much danger, "run out of gas" without crashing. Still, they too must know their position. They can afford to rely extensively on celestial navigation for they have more time for getting fixes and delay does not involve such great risks as it does for their sisters of the air. Nevertheless, on the Great Lakes, along the coast, on certain inland waterways at night and under overcast weather conditions, they, too, look to the radio direction finder for guidance. For many years, ocean ships have used manually-operated radio direction finders, requiring skilled radio men. Now however, they are looking to ADF.

There is real drama, however, when radio and the heavens combine to avert impending disaster and bring about a happy ending. Such an incident occurred when a large war cargo plane, approaching its tiny island destination in the North Atlantic, developed battery trouble. No electrical equipment could be used. To add to the desperate circumstances, the navigator could not find a break in the sky. The crew waited patiently, hoping for sunrise before the gas tanks ran dry. At last the navigator was able to take a sight on the sun and from it to plot a line of position. The radio operator, by heroic or miraculous efforts, got enough life out of the batteries to obtain a line of position through the radio station on the island. Where the two lines crossed was the plane's position—they were a number of miles past the island. Again, radio compass guided the crew to safety. END

Death of the 'Wasp'

(*Continued from page 47*)

"I'll never forget the 15th of September. We were then about 200 miles southeast of Guadalcanal, steaming in with a task force of cruisers, destroyers and other ships to cover the landing of reinforcements. It was a typical South Pacific day, with brilliant sunshine and a few scattered cumulous cloud puffs. Along about mid-afternoon my flight of Grumman *Wildcats* took off for combat patrol over the carrier. It was an extra job for me and my roommate was taking a nap in our stateroom when I left.

"At 3,500 feet I looked down to take position on the flat-top. I was utterly unprepared for what I saw: two waterspouts rearing high above the superstructure; smoke and flame bursting out amidships.

"'Torpedoes!' I told myself, swallowing hard. (One, I learned later, hit near my stateroom, killing my roommate and about 20 others in the vicinity, including Jack Singer, International News Service correspondent.)

"I circled down, with the other planes, in the hope of getting a crack at the Japs. I came down as low as 100 feet, peering vainly into the sea for just one glimpse of a sinister shadow that spelled submarine.

"The *Wasp* went into a hard left turn. When she had swung around only about 90° the fire subsided and I felt the worst danger was over. But just then a terrific explosion cut loose and smoke and flame leaped from the starboard side of the ship. I figured it was another torpedo but learned later that it probably was one of our own bombs, set off by blazing aviation gasoline ignited by the twin tin fish.

"As the stricken carrier completed her circle, our bombs were exploding at intervals. Clouds of bright red fire erupted from both sides, below the flight deck, billowing out 200 yards, leaving black smoke streamers and scattering little pools of fire on the water. Sprays of red, yellow and green Very lights shot out like Roman candles.

"The skipper, Capt. Forrest Sherman, had decided beforehand what to do in such a situation. After circling, he backed the *Wasp* into the wind to restrict the fire to the bow and allow the crew to abandon ship from the stern. All this time the ocean literally was torn apart by depth charges dropped by our cruisers and destroyers darting among the heavier ships. When a pattern of charges exploded beneath the water, the surface quivered violently and a few seconds later several geysers rose high in the air. I saw another warship take a hit from a Jap torpedo. She shuddered but changed neither course nor speed. Another ship survived the effects of a torpedo hit without the loss of a single man and steamed cockily away for repairs so she could fight another day.

"In about 15 minutes it looked like at least two-thirds of the *Wasp's* crew were lined up on the flight deck, ready to abandon ship or carry out other orders. There was no confusion. I saw men pushing some of our $75,000 Grummans over the side in order to localize the fire and better distribute the ship's weight.

"Came the order to abandon. The

DECARBONIZING

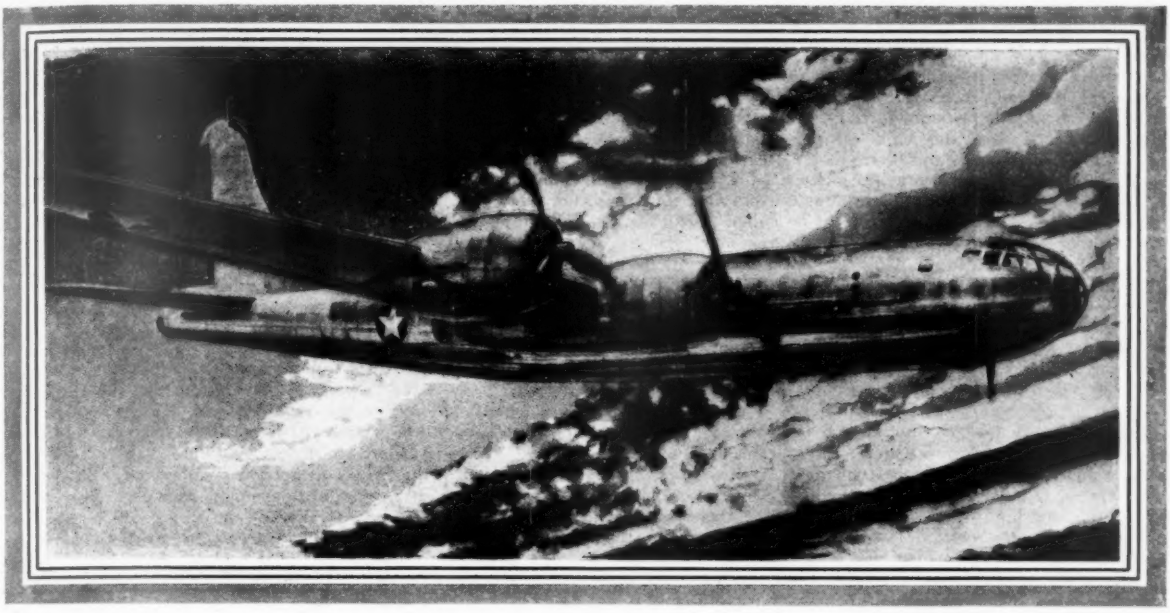
Aluminum Surfaces Without Etching or Loss of Weight!

A Specific for Cleaning:
Link Rods, Cylinders, Carburetors, Fuel Pumps, Oil Coolers, Injectors, Paint Stripping, Cartridge Starters, X-Collector Rings.

Guaranteed to exceed the performance requirements of most recent army, navy and air force degreasing and decarbonizing compound specifications.

"80" Aircraft Piston after two hours at 140° Fahrenheit in Hydro-sealed carbon gum digestive solvent (unretouched photo).

Send For Bulletin.



When So Much Depends Upon So Little!

It is a source of great satisfaction to G. Felsenthal & Sons, pioneers in precision made plastics, that their facilities are responsible for so many instruments essential to the effective operation of a B-29. Five of them are pictured . . . regulations prevent the showing of others. All five are easily packed in an ordinary navigation kit without crowding . . . proof that so much can depend upon so little.

Only instruments "A" and "E" are available commercially. At Post Exchange, Ship Service Stores, also Stationery and Book Stores.

(A) *Dalton Dead Reckoning Computer*
(B) *True Air Speed Computer*
(C) *Altitude Correction Computer*
(D) *Oxygen Computer*
(E) *Weem's Aircraft Plotter*

Precision made in

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crew slid down lines in orderly fashion, although some jumped 70 feet from the listing flight deck into the sea. In the excitement several forgot to take off their steel helmets; when they struck the water the sudden pressure forced the helmets upward and the chin straps snapped back their heads and broke their necks. Most of the crew wore life jackets; the flyers had donned their Mae Wests.

"Soon there were hundreds of faces dotting the ocean's surface. They were swimming in a lake of aviation gasoline and Diesel oil, formed when storage tanks were ruptured by the explosions. As the carrier burned more fiercely amidships, with tongues of flame leaping from both sides, the fuel caught fire and the inferno threatened to engulf the helpless men. It looked like hell: the life rafts bobbing in the water were rings of fire, offering no haven to the swimmers. I feared they were doomed. But fortunately the flames spread only 100 feet or so from the hull, which by now was glowing red hot from the conflagration raging inside.

"Captain Sherman and the admiral were the last to leave the ship. Lieut. Ray ("Tubby") Conklin was among the last, helping a wounded man down a line into the water. Comdr. Courtney Shands, commanding the carrier's air group, later told me this story about Tubby:

"'I was towing a wounded man away from the ship,' he said, 'and was overtaken by a swimmer helping another casualty. To my surprise I saw it was Tubby, with a big man—much heavier than my own tow and pasing me on the double.

"'Hi, Captain, how about trading men?' called Tubby, jokingly.

"'I replied, 'Nothing doing—I've got my hands full.'

"'Then I discovered the reason for his speed. He was putting water between him and a big hungry shark!'

"Sharks got at least one member of the crew, I heard. And an officer, badly burned, swam in great pain toward a destroyer; he died as he was pulled aboard.

"A gunnery officer, with whom I talked later in a hospital, told me he was standing near a forward gun position when a torpedo struck below him. He was blown 60 feet into the air but was lucky enough to fall onto the bridge, high above the flight deck. He escaped with a broken leg and other less serious injuries.

"Two and a half hours after the *Wasp* was attacked, the pilots circling overhead were ordered to seek another roost. The carrier was listing to port, with nearly all hands over the side, and other ships were proceeding efficiently with rescue operations.

"My last view of the flat-top was blurred with tears. I'm not ashamed to admit it. She had been my home for eight months, and I was strongly attached to her. Scores of the boys aboard were my pals.

"I came down safely on another ship; so did the other pilots. A few hours later the *Wasp*, a helpless, wallowing hulk, was given the *coup de grace* by our own ships and sunk." END

Disposing of Surplus Warplanes

(*Continued from page 55*)

much greater than the total demand for such planes by all commercial air lines.

"There is, however, another very important use which may absorb a substantial proportion. This is for the heavy movement of military and official personnel as well as emergency supplies, medicines, etc., which will be involved in the rehabilitation of war-torn Europe and Asia.

Class C: Smaller planes with non-military uses ranging in size from 1,200 to 11,000 pounds gross weight. These will be useful for:

1. "Nonmilitary Government divisions (e.g., Civil Aeronautics Administration, Forest Service, Fish and Wildlife Bureau, state police.)
2. "Special commercial activities (e. g., topographical mapping, crop dusting).
3. "Corporate flying (e.g., executive travel, pipe-line inspection, sales promotion).
4. "Fixed-base operators (e.g., instruction, charter, rentals, resale, private training).
5. "Government-sponsored flight training.
6. "Personal flying.
7. "Export."

Class D: Major components, including engines, propellers, instruments, and radio equipment in finished form. Not included in this group is combat material, such as bomb sights and machine guns, small components, such as electric motors, and items which become more or less integral parts of planes, such as hydraulic systems.

According to the report, such components could be sold either as parts of surplus or new planes or as spares and replacements.

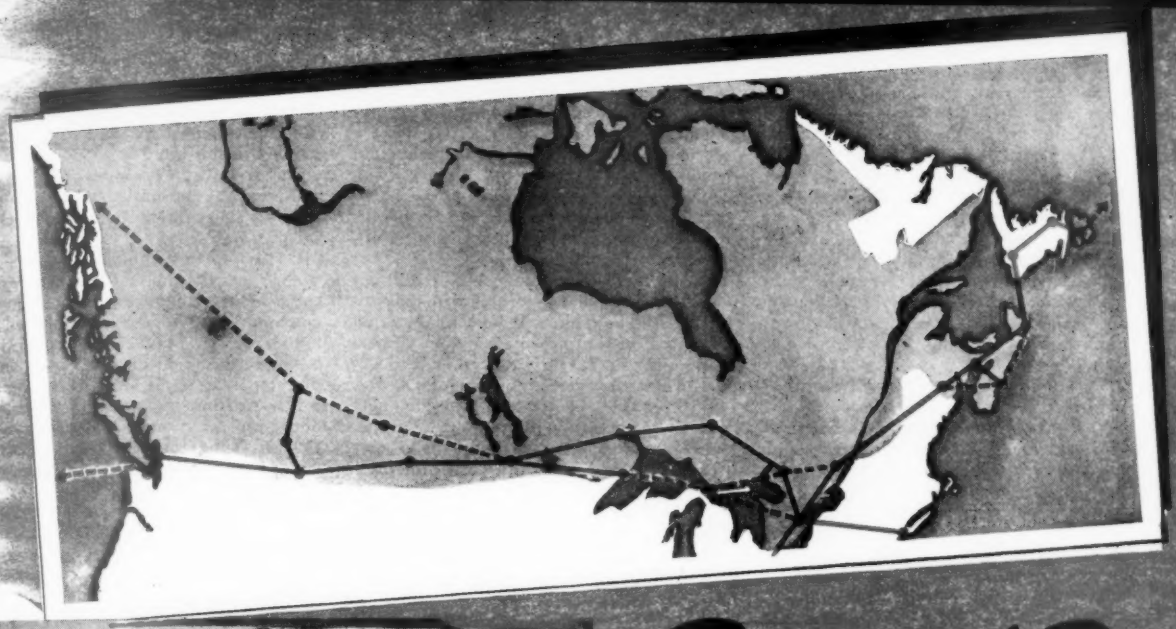
The report warns that, in the interests of aviation in general, such parts should not be allowed to fall into the hands of persons more interested in profits than in human safety.

Class E: All other planes and components. This class includes all aircraft and parts determined by survey to be in unsound condition. Planes and components originally placed in classes A through D may later be placed in this group, once it is determined there is no further military, commercial, or export demand for them.

In establishing policies for the disposal of surplus aircraft, the report states that the Army Air Forces have certain major objectives which are of prime importance

FLYING

"I can remember when he used to run like that for the Long Island railroad!"



Returned War Pilots JOIN TRANS-CANADA AIR LINES

The job of training returned airmen for peace-time commercial transport flying has begun in Canada. Already engaged for the flight crews of Trans-Canada Air Lines are a number of Royal Canadian Air Force pilots who have distinguished themselves on operational duties overseas.

The first group of veterans to join T.C.A. is shown above in Link Training quarters in Winnipeg. Left to right, they are:

Flying Officer R. S. WHITE—*40 operational flights, including 14 raids over Germany; service in Egypt, Libya and Malta*

Flying Officer H. H. BOLTON—*Coastal Command, Great Britain, operational flights as far as Iceland*

Flight Lieutenant E. L. HOWEY, D.F.C. *As member of Dumos Squadron, took part in several 1,000-bomber raids on Germany*

Flying Officer J. C. MORDEN—*34 operations in Wellington bombers; service in Egypt and Libya*

Flying Officer C. R. FOGAL—*service in Scotland, Gibraltar, North Africa*

Their tours of duty over and physically fit, these men are now learning air line procedure. Link instruction in instrument flying is an integral part of this training.

B. A. Rawson, Supt. of Flight Operations for T.C.A., starts Flight Lt. Howey, D.F.C., on his air line instrument flying course in the Link Trainer.

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3. "A reservoir of service pilots, instructors, mechanics, radio-men and other skilled ground and flight personnel;

4. "Strong aircraft manufacturing and air transport industries, with the maximum practicable employment and capacity;

5. "Public support of United States air power adequate for future security."

Furthermore, the report states that the War, Navy and State departments "should have the objective of using surplus disposal as a positive instrument to create sound foreign relations and future trade, especially export trade, which may expand United States aircraft productive capacity."

The Harvard experts add that the maximum dollar return to the Government should be obtained from such disposal, but that such an aim should be secondary compared with the vital need for military preparedness and international accord.

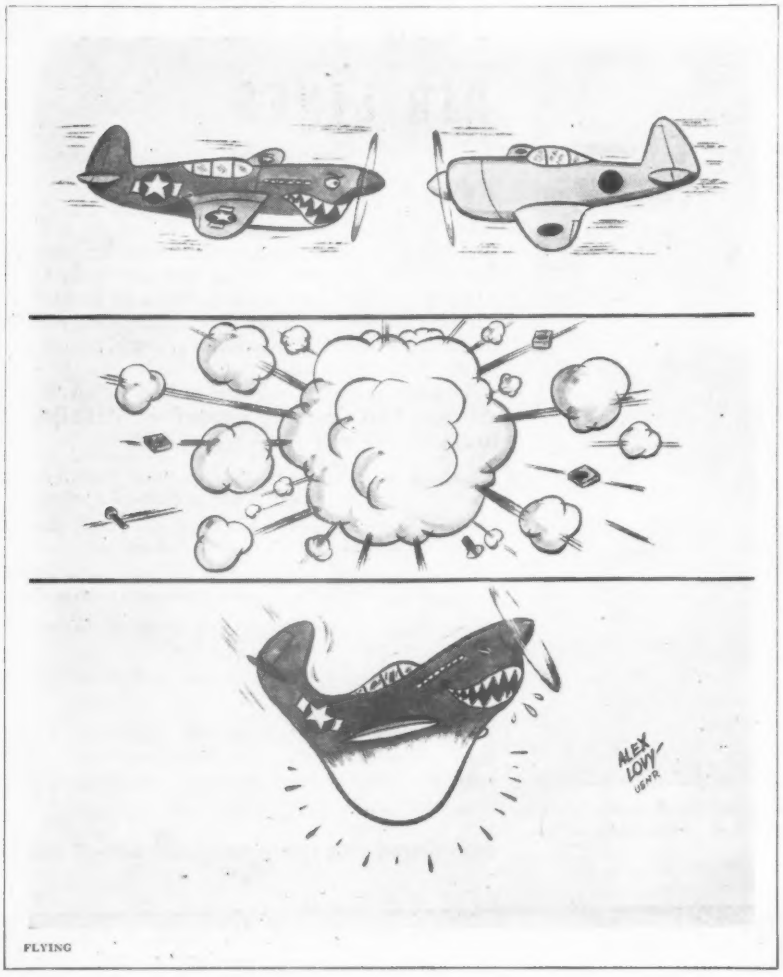
Timing is the key to sound disposal policy because of the rapid rate of obsolescence of aircraft. The report recommends:

"The sooner the surplus planes and components are made available to domestic and foreign markets during the latter phases of and immediately after the war, the more completely will the desired objectives be achieved.

"The immediate use commercially of surplus equipment before new models are generally available will tend to act as an incentive to technical development, not a drag; it will aid in broadening the demand for improved equipment; it will better enable the United States to meet foreign competition for export markets; and the sooner sales are made, the greater the dollar return to the Government is likely to be."

According to the Harvard report, surpluses of equipment useable in wartime civilian economy should be distributed as soon as their military essentiality is past. However, the report adds:

"In later post-war years, however, after new improved equipment is generally available, it is recommended that, in order to prevent interference with experimentation and new production, the distribution of surplus planes and components should cease.



"It is suggested that such a ban on further surplus distribution might become effective about three to five years after the end of the war."

The following recommendations were made by the Harvard experts as a guide to War Department policy in declaring surpluses;

1. "While there might be some advantage in maintaining as large a reserve of equipment as can be stored even after more or less stable peace is established, the Army Air Forces will probably fare better in terms of adequate material if it divests itself of all truly excess and obsolete wartime equipment. Only by so doing can the Army Air Forces avoid the risk of being forced to use obsolescent equipment during the permanent military establishment (as it was forced to do during the decade after the first World War.

2. "For combat models, the Army Air Forces obviously should keep only the most recently produced equipment, declaring as surplus the oldest and most physically remote equipment.

3. "With regard to transport models, for which minor differences in operating costs are relatively unimportant to the military, the much greater commercial value of the latest models suggests that more of these planes may be put into action on the United States air routes and at a higher return to the Government than would be possible if the Air Forces released at first the older and more used military transports which would require meticulous overhaul and time-consuming conversion."

After the Army Air Forces declares a given number of planes in a particular theater "surplus," and the War Department specifies no other military need for them, all the used planes should be surveyed at location to determine whether they warrant overhaul or preservation or whether they should be broken down into salvageable components, the report says. The report adds:

1. "Standards to determine whether a plane or component is to be salvaged or retained whole should be fixed with reference to 'residual value' (residual value may be defined as the estimated value of such additional service which may be expected from each airplane less the cost of putting the airplane in the required condition and location to render that service).

2. "While these surveys could probably best be conducted by the Army Air Forces personnel, the standards and policies should be prescribed by the independent disposal board. (Otherwise, the Army Air Forces will be vulnerable to the same type of public criticism which followed the burning of planes in France after World War I).

3. "In estimating the residual value of any given plane or component, local authorities could make reasonably accurate estimates of the costs of overhaul, repair and transportation to place of sale.

4. "The standards should be set up in advance, both to get the job done quickly when a large surplus occurs and to avoid hasty judgments at that time which may

(*Continued on page* 118)

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(*Continued from page* 114)

incur subsequent punitive investigation. Once established, moreover, the standards for valuing different items would have to be checked and altered constantly as prospective market conditions change."

Many problems were considered in connection with the disposal of various types of planes and component parts. For instance, there is no assurance that major powers will agree on limitations concerning the international sale of combat aircraft. The report adds:

"Inasmuch as international balance of air power may be affected, the Air Forces should have full representation and should have veto power over any action deemed adverse to military security. The State Department should likewise have veto power over any action deemed detrimental to our foreign relations."

The Harvard experts suggest that plans be determined in advance so that this nation may be in a position to offer its surplus aircraft in exchange for those bases, landing rights, strategic minerals, or other considerations which may best fit America's needs.

"Gifts should not be made merely for the sake of being good neighbors," the report adds; "experience casts doubt on the creation of lasting good will by such gifts."

These students of post-war aircraft disposal agree that while dollar price is at best a secondary consideration in the disposal surplus aircraft, a uniform price to all buyers should be the key control device in determining both uses and distribution of planes for commercial purposes.

"All schemes should be avoided which consider mere disposal, as such, the major objective," the report adds. "For instance, wholesale extension of airline routes, a nationwide network of feeder lines, or widespread tramp cargo operations should not be initiated merely because surplus planes exist. Perhaps timing is right for all these developments, but the Civil Aeronautics Board, taking all factors into account, should make the decision, not the surplus administrator."

The investigators insist firmly that neither the original manufacturers nor any other party should be permitted to purchase exclusively large blocks of a particular model for speculative resale. The Harvard men agreed that it would be unwise to repeat the sad experiences of World War I, when certain manufacturers bought outright most of the surplus models sold by the Government.

While the monetary return to the United States is stressed in the report, the writers add that it might be necessary to waive such a price policy in sales to foreign countries. The report says:

"At the time of the peace conference (or at any conferences regarding international aviation), our surpluses are likely to become 'a pawn in a larger game' involving foreign bases, landing rights, strategic materials, and general foreign policy.

"Present indications are that certain models may be among the United States' more important pawns. Obviously such distribution of surpluses must be arranged by the Government, not by manufacturers, and the consideration is likely to be in terms of rights or other non-dollar considerations."

One important new field of operations mentioned by the report concerns certain contract cargo activities, such as the movement of fresh fruits to northern industrial markets, a situation that might be possible because of low-cost surplus equipment. The reports said:

"Such use of surplus planes, especially by small owner-operators who might be able to operate with low overhead costs, may give an otherwise unrealizable impetus to all-cargo transportation."

In the resale of smaller planes, the report warns that every precaution should be taken to insure flying safety.

"A careful inspection of individual planes will probably reveal that in the interests of air safety a large number should be scrapped rather than sold," the report said.

The Harvard experts advise establishment of a special Government branch to control the distribution of equipment to educational institutions. Specific comments concerning this field are:

1. "Discussion to date indicates that a considerable amount of nonsensical action will occur unless well-thought-out programs are planned in advance.

2. "Specific plans must be made regarding distribution to private aviation trade schools as well as private nonprofit educational groups and public institutions.

3. "Surplus Class E equipment should be sold to nonprofit public educational institutions at a nominal price. While most such institutions cannot afford to pay high prices, outright gifts would encourage extravagant and irresponsible use of the equipment.

4. "The contract of sale to educational customers should prohibit use of the equipment for commercial purposes. Resale should be also prohibited." END

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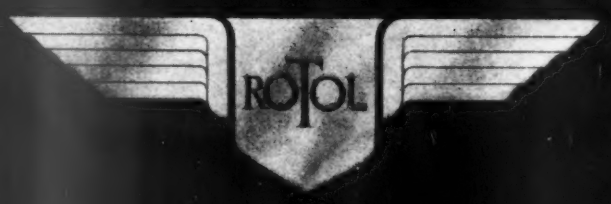
15 YEARS AGO

FROM the September, 1929, issue of this magazine:

One of the most heavily-defended spots in the world in 1944, the Panama Canal area was described by Gen. William Mitchell as "defenseless." Pointing out that air power had already "superseded sea power" both as a means of controlling the sea and defending the country, he predicted that it would also become the "offensive arm par excellence of a nation."

There was much talk about the various experiments in vertical flight. More or less successful helicopter models had been projected by such pioneers as De Cierva, Pescara, Klemin, De Bothezat. But despite advances, Ernest W. Fair reported that "no machine has as yet been developed that will rise vertically . . . and there is no true helicopter that will carry a useful load or that will descend safely should the motor or motors be stilled. . . ."

One of the many surprises sprung at the Cape Henry Naval maneuvers was the use of an air-borne right angle torpedo. John Goldstrom, who reported the maneuvers said: "One of the planes flew on a course parallel with the *Arkansas* and, when a short distance ahead, shot its bolt. The torpedo traveled on the parallel course for only a few yards and then, controlled by a special mechanism, turned at right angles and headed for the side of the ship. It was a direct hit. . . ." END



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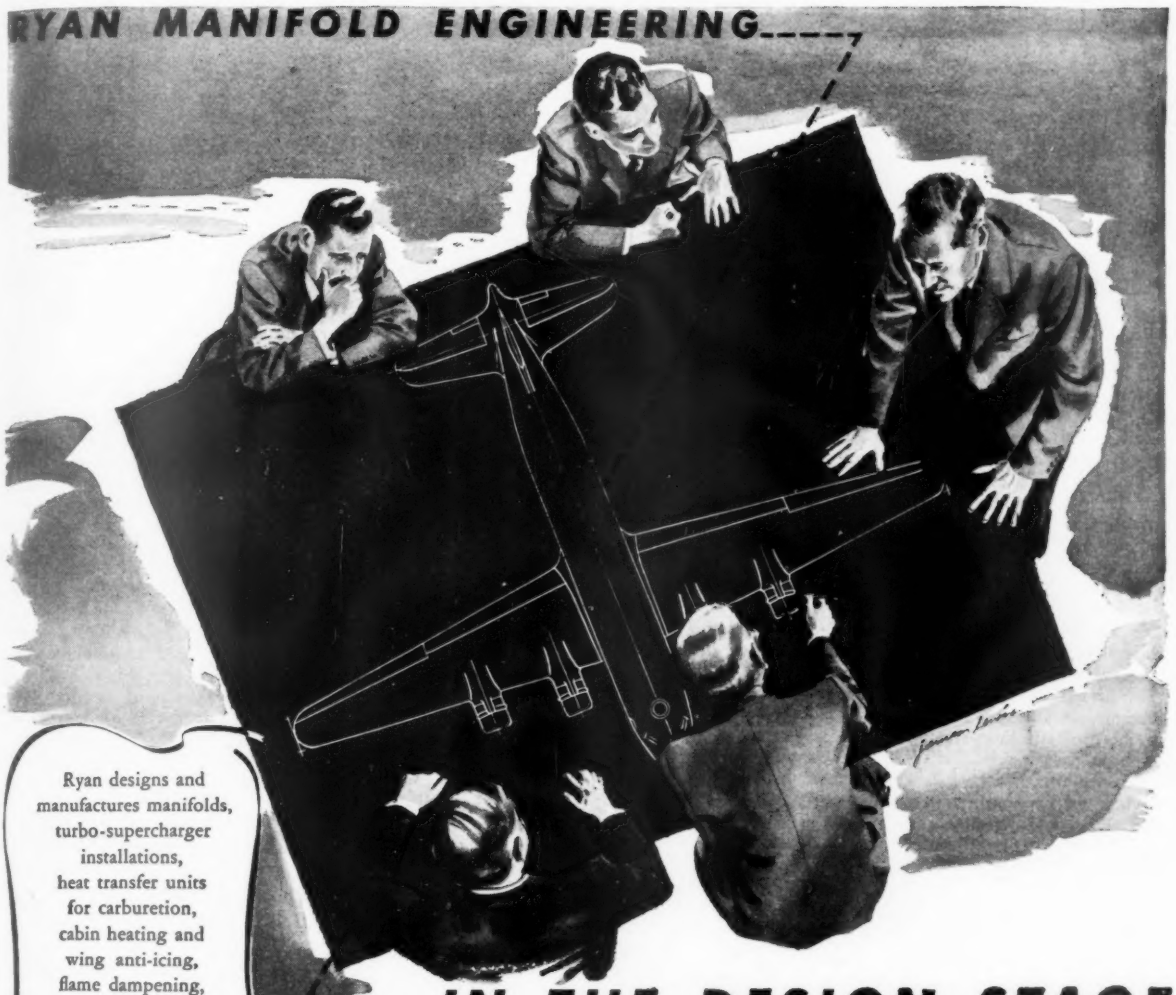

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Incentive Pay in Aviation

(*Continued from page 60*)

type of bomber; reductions of more than $10,000 were made during the same period in two fighter types. At the same time, Grumman has achieved a 40 per cent increase in production with 5,000 fewer employees than it had originally estimated would be necessary to attain peak output.

From the numerous examples of accomplishments, however, it must not be assumed that the path of incentive plans is an easy one. They present technical difficulties of management and labor policy and, in fact, they are generally opposed by both management and labor.

Management opposition to incentive wage proposals stems largely from a feeling that they are a "headache" to operate, requiring the close attention of competent engineers, a lot of red-tape and bookkeeping. Many employers also have an added fear of union trouble if they advance such schemes, some consider incentive plans a "bribe" to workers to do the work they're paid for performing, and still others oppose such plans because of ignorance of their operations.

The first factor probably is the greatest deterrent. Managements shy away from the chore of administering incentive pay proposals properly. In a plant of 1,000 employees, for example, it is estimated that four or five competent engineers are required to keep an incentive program running smoothly, adjusting time-standards, rates and methods. The close attention of top management officials is mandatory if such plans are to avoid trouble.

From the union standpoint, there is always the old bogey of stretch-outs, which labor fears in any shape or form. A poorly devised incentive wage plan, improperly administered, brings the threat of a stretch-out with undue emphasis on the performance of a star worker, unions believe. There is the threat that work standards would skyrocket to the level of a few top employees.

In addition, unions fear that incentive wage programs might start a cycle contrary to established trade union principles and lead to the point where unions would lose their right to determine work standards through the processes of collective bargaining.

Incentive wage plans usually fall into one of three broad classifications: (1) individual reward, (2) departmental rewards, (3) plant-wide incentives. The Grumman system comes under the third heading and is an adaptation of the Beech plan. In the first three months of its operation—October, November, December of last year—Grumman obtained a gain of 34 per cent in production. In the first quarter of 1944, production was up 40 per cent over the base period.

Although the plant-wide incentive has been most widely adopted in war plants, the aircraft industry has tried all three types of plans. Grumman, Beech, Republic, and Chance Vought use the plant-wide incentive system; Pratt & Whitney engineered its plan on a departmental basis, while Edo based its incentive program upon a complete time study of each operation for every individual part manufactured. The latter system—geared to the individual worker—admittedly presents problems, but Edo has not found them insurmountable. The system requires a large force of competent time-study men to keep up with changes in methods, operations and items.

WPB's Nickerson believes that in ordinary times incentives applied to individuals and small groups produce better results but he recognizes the effectiveness of plant-wide incentive plans during the war. He says that "there are clear indications that, with enthusiastic support of management and labor, standards may be set for an entire plant based on actual production per man hour, and incentives may be paid to all employees as a proper reward for the extra effort and accomplishment."

Plant-wide incentive systems have the advantage of rewarding production and non-production, administrative and executive employees alike. They also have tended to remove one of the traditional complaints of organized labor that incentive schemes establish speed-ups or sweat-shop conditions—since no standards are fixed for the production of the individual worker.

Beech Aircraft at Wichita, Kans., under its vice-president and general manager, John P. Gaty, was one of the first aircraft industries to enter the field of incentive wages. The initial system, a profit-sharing plan, was negotiated with the employees in December, 1941. A tremendous increase in production resulted. Under the plan, basic wage scales were frozen but not the pay of the individual, and employees were allowed the benefits of advancement and upgrading.

After more than a year of operation under the profit-sharing plan, Beech shifted to another basis for computing incentive payments because renegotiation of contracts had reduced the price of its products. The last quarter of production under the profit-sharing system was adopted as a base for computing future production results. At the time the changeover was made, Beech employees had attained an incentive rate of approximately 49 per cent of basic wages.

Under the new plan, Beech compared the pounds of airframe weight per work hour with the same figure for the base period. For a one per cent increase in airframe poundage per work hour, an incentive pay increase of one-half per cent was applied to the 49 per cent basic incentive rate previously attained. In the first seven months after the changeover, a further increase in efficiency of more than 28 per cent was attained.

One of the great difficulties in instituting wage incentive plans in the aircraft industry grew out of its rapid expansion after Pearl Harbor. Incentive wage experts recognize that a plant should have about a year of fairly static production experience upon which to predicate a plan. In the aircraft industry, however, plants mushroomed overnight, aircraft schedules constantly were being accelerated, and manpower and materials were far from stabilized.

Another difficulty involved the tendency to regard incentive proposals as a cure-all for salary grievances arising from application of the Government's stabilization program as embodied in the so-called "Little Steel" formula. This

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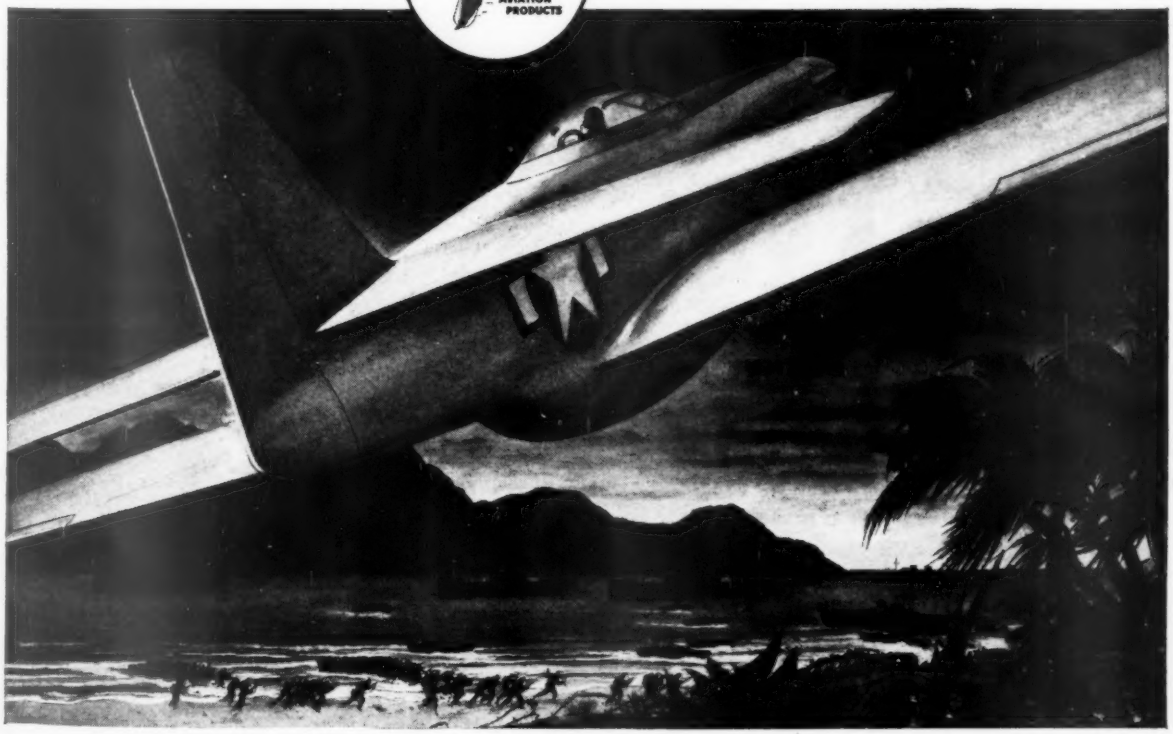


Government yardstick limits wage increases to 15 per cent over the level of Jan. 1, 1941.

"During the past year, management and labor alike have been looking toward the wage incentive as a panacea for economic ills of all kinds," Nickerson explained. "Wage stabilization rulings have provided the chief motives for this trend. Many in labor see incentives as the only feasible way of obtaining higher earnings; many managements wish to make use of them either to hold their present workers or to attract workers from elsewhere.

"The real motive for our present deep interest in wage incentives must be production and more production. Along with production comes the conservation of our diminishing supply of manpower."

The National War Labor Board, in endorsing the principle of wage incentives as a spur to war production, made it clear that, to receive the board's approval, such plans must conform to the national stabilization policy and be agreed upon jointly by management and the union. The WLB will not order such plans in dispute cases.

In the Grumman plan, the Board had only the first factor to contend with since no union was involved. In the Board's opinion unanimously approving the Grumman plan, WLB Vice Chairman George W. Taylor warned, however, against "obvious and sometimes clumsy attempts to provide hidden wage increases." In summing up the problems bearing on the issue of plant-wide incentive plans, Taylor continued:

"The overall wage incentive program is novel and can only be thought of as an experiment to meet the exigencies of war. . . . At best, the overall wage incentive is a 'rough and ready' procedure which will not result in nicely balanced equitable wage relationships."

The WLB official expressed the opinion that overall wage incentives should not be introduced "if marked changes are in prospect as respects changes in orders or specifications, the degree of management contribution, or technological developments."

"It is important that such matters be fully understood by employees and employer when such an incentive plan is inaugurated," he said. "They should also understand that, if the variables attain significant influence, a change of the basic standards may be required in order that the program will conform to the requirements of the national stabilization policy . . . the NWLB believes that no overall incentive wage program should be undertaken where there is a likelihood of extreme fluctuations in variables already noted." These may be some of the reasons why the Board required a periodic review and appraisal of the Grumman wage incentive plan.

"In the interest of production, Miss Powers, you must remember that here you are not a woman!"

In a concurring opinion on the Grumman case, Carl J. Shipley, CIO member of the WLB, and John Brophy, also a CIO representative, gave labor's approval, basing it on their belief that proper incentive systems would contribute to winning the war. They warned that labor wanted such plans limited to war industries and war products during the current war emergency.

"Labor is traditionally opposed to incentive plans," they said. "While giving its all, labor must protect its hard-won basic privileges on the home front. Labor has the responsibility of protecting its objectives of eliminating all forms of stretch-out so that after the war it will not find itself in the position of having helped to win the war but at the same time having lost the right of determining work standards by free collective bargaining.

"Plans for individual and group incentives, as against plant-wide incentives, may start a vicious cycle contrary to trade union principles."

Labor also demanded that incentive payments be in direct proportion to the gain in production—one for one.

In the Beech and Grumman plans, however, the incentive was one-half for one. Grumman obtained a 34 per cent boost in production in the first quarter of the plan's operation and its employees received an incentive payment of 17 per cent. For the employee who had been receiving a straight time wage of $1 per hour on a 56-hour work week operation, the aggregate incentive payment approximated $142 for that quarter.

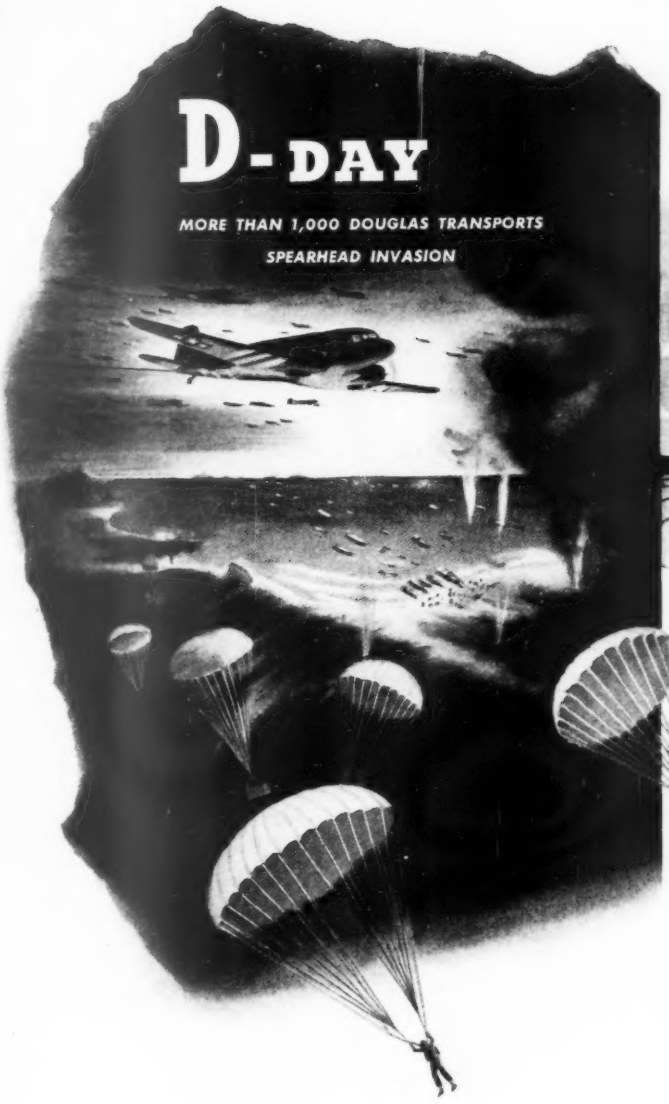
One other point is that such systems must consider the factor of subcontracting if employees' earnings are not to be distorted. Beech failed to do this in its early plan. Subsequently, an increase in the firm's subcontracting operations required alterations in the incentive pay plan. A sliding scale arrangement was drafted to compensate for fluctuations in subcontracting.

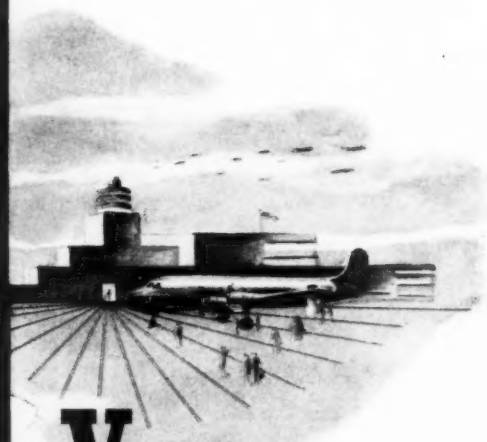
It also has been found necessary to explore other channels for increasing productive efficiency—rearranging assembly lines, ascertaining that employees are fully trained, and making certain that production is stabilized—before putting incentive plans into operation.

Prospects for extension of incentive wage systems to other aircraft manufacturing companies at this time do not appear too promising and the post-war use of such plans is still in the realm of speculation. It already has been noted that labor placed a wartime limitation on such proposals.

Moreover, there is the added post-war certainty that aircraft production will decline very greatly from its war peak. The "quantity" motive behind incentive wage plans will be altered to an appreciable degree.

The idea of paying a worker more for greater output is not new. The Russians have used it to great advantage in supplying their armies with the weapons to drive out the Nazi invaders. Its future in this country remains a matter for management and labor to decide. END





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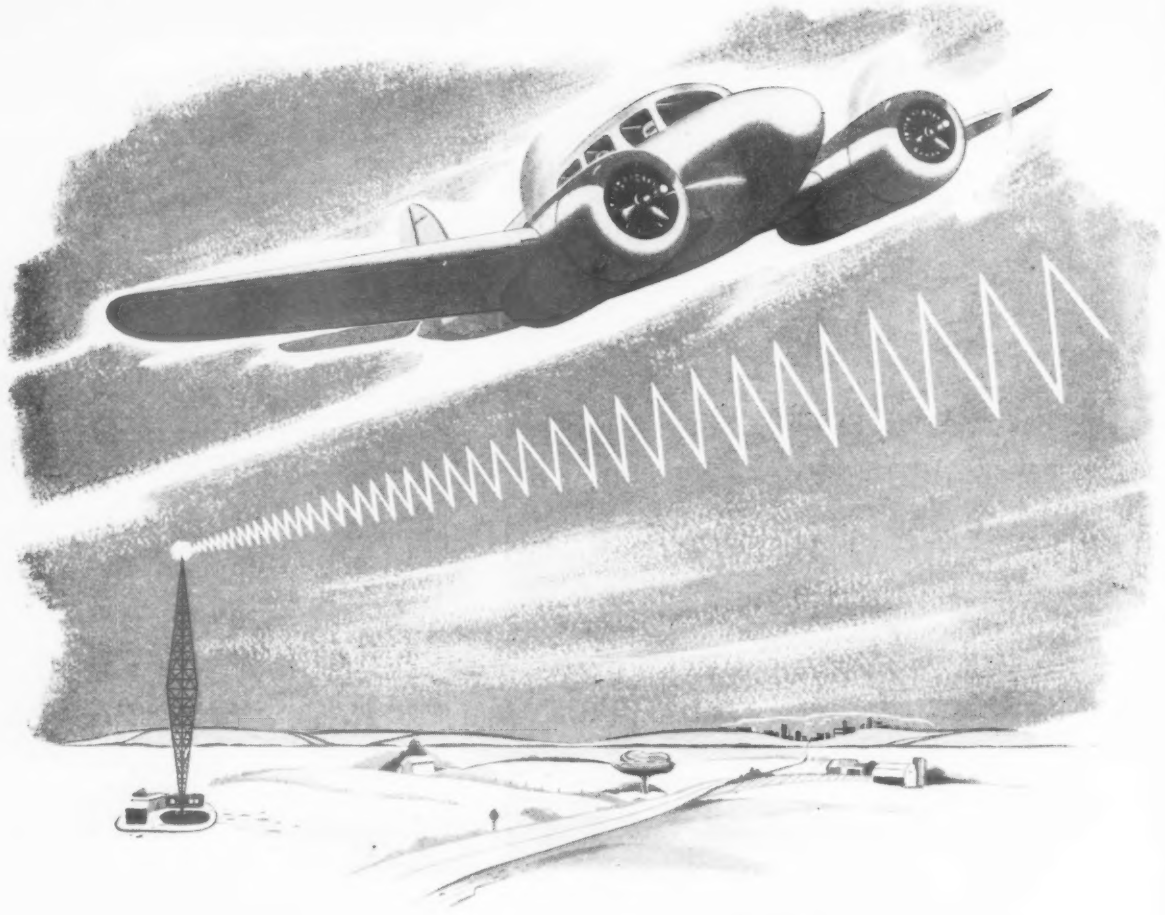

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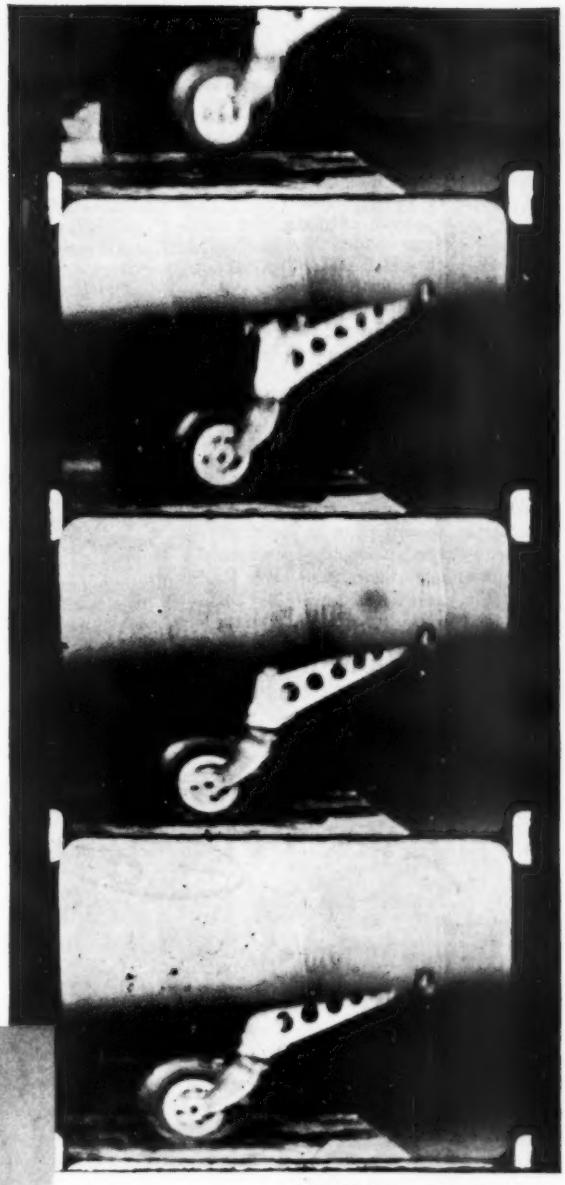
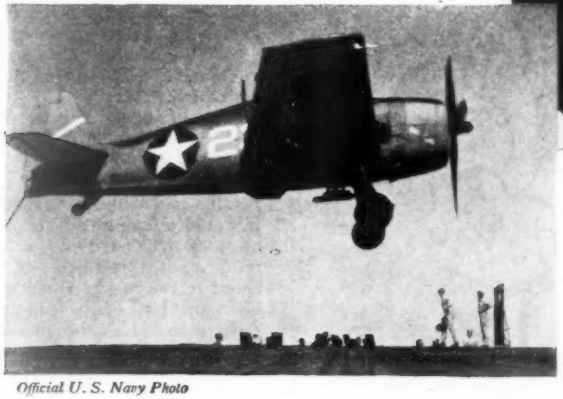


Official U. S. Navy Photo (Unretouched)

Under full load, the tail wheel tire strikes the landing strip and squashes almost flat under the impact.



Official U. S. Navy Photo

A Navy Grumman Hellcat fighter comes in for a landing on a first line aircraft carrier operating in a Pacific Fleet task force. Where you find the Navy's fighters, you'll find U. S. Royal Airplane Tires on deck.

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Jet Bomb

(*Continued from page 25*)

merely by observing a few elementary safety rules. My sense of sound, well keyed after several days and nights of listening, warns me fairly accurately when to expect the explosion. I don't stand near glass windows or doors and I endeavor to get a good, substantial bit of masonry between me and the direction from which I expect the blast.

A few personal experiences with these flying bombs has led me to several conclusions. Even before it can be seen, a trobbing pulsation like a turbine generator can be heard as the bomb approaches. As it passes, a bluish-white smoke is discharged from the funneled stern section. At night this glows a brilliant orange-red with exhaust flames spouting about six feet out to the rear. The flames are invisible in daylight.

A horn-shaped resonator by which the air velocity operates flutter-valves in the jet engine creates the terrifying noise—a typical German psychological trick.

An official statement and a provisional sectional drawing of the German flying bomb was released to the British press recently. In it, the bomb was described as being jet-propelled and launched in France from a "ski-jump" ramp arrangement, possibly accelerated in its take-off by a rocket booster. The theory has been advanced that a well-concealed automatically-operated hydraulic catapult might also be used for propelling them at the start.

The fuselage, cylindrically-shaped and tapered like a marine torpedo, is 21 ft. 10 in. long with a maximum width of 2 ft. 8½ in. The overall length is reported to be 25 feet 4⅓ in. The wing span is 16 feet.

The explosive, estimated in various amounts up to 2,200 pounds, is carried in the warhead mounted in a thin casing at the front of the fuselage. The bomb is built almost entirely of pressed steel with welded joints. It is painted a dull blue, apparently as camouflage.

The flying bomb is controlled in flight by an automatic pre-set gyro pilot and flies on a fixed straight course at any predetermined height. The height of flight can, no doubt, be altered.

Berlin radio has this to say: "The altitude can be adjusted and, according to the desired effect, with a choice between a shallow and a steep dive. The missiles are being hurled against England in accordance with a precise plan.

"The flying bomb can be used in three ways: 1. Single take-offs. 2. In series—a process called 'feuerschlag' (firing blow). 3. Mass take-offs at irregular intervals.

"Atmospheric conditions make no difference except that they may impede both observation of the results and the enemy's defense."

The flying bomb contains three air-driven gyros as well as automatic apparatus to control height and range settings. A pneumatic servo mechanism operates the rudder and elevators. A single spark plug, two-stroke engine furnishes energy for the turbine in the jet-propulsion unit. The fuel tank has a capacity of 130 gallons of fuel and it is estimated the present models have a range of 150 miles, depending on the direction of the wind.

The mechanism is also understood to contain a compass and a delicately-balanced instrument that keeps the flying bomb on a general course by compensating automatically for wind drift. It is believed that a minature radio transmitter or "radiosonde" is installed in an occasional missile which sends out a "peep" signal on a predetermined frequency every 10 seconds. This is recorded by a receiver at the launching ramps to determine where the explosion took place by the simple calculation of measuring speed against the known distance from the target.

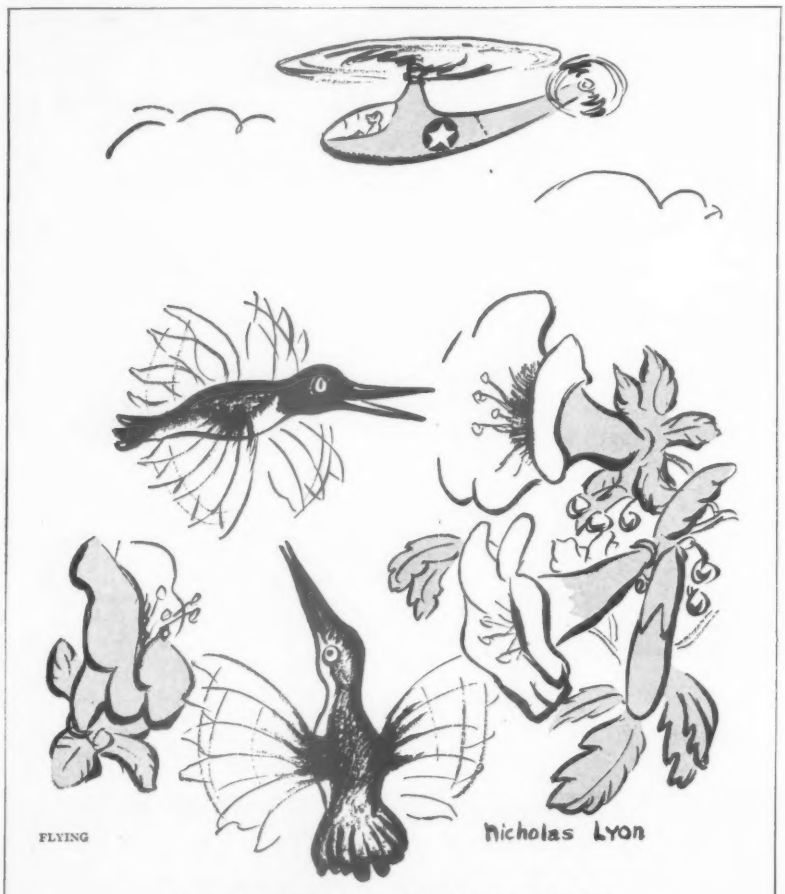
The explosive charge causes a terrific blast, but by lying face down with nothing more than a street curb for protection, possible victims have been known to come through unscratched.

According to F. G. Miles, famous British aircraft designer, who in 1939 and 1940 perfected a similar flying bomb for possible use by Britain, the German version contains no superhuman quality and should not be so regarded.

"I'll admit that it's an ingenious invention," said Miles, "but there is nothing eerie about it. It is no use trying to belittle the effect of these projectiles but there is nothing about them that cannot be dealt with effectively."

The Miles flying bomb weighed 1,000 pounds and could be catapulted so that it would automatically climb to a height of 10,000 feet. It had a range up to 400 miles at this elevation and traveled at a speed of 300 m.p.h. An idea of how the Germans have advanced this design is obvious to those who have seen the present type in flight. Miles estimates that the flying bombs now being hurled into southern England cost the Germans only between $2,000 and $4,000 each and can be produced in large numbers. They are much cheaper than a marine torpedo.

It is believed that a forerunner of the present type of flying bomb appeared in Sweden several years ago when protests were made by that country to Germany concerning the discovery of such a missile there. Developments were watched more closely as Germany approached war. The flying bomb has been held in its present form until now and referred



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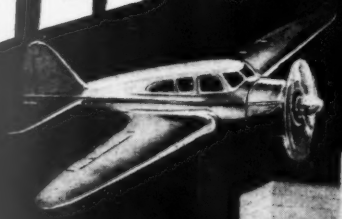

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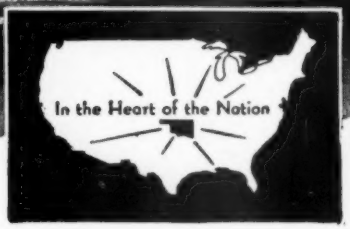

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From Stockholm reports came naming a Professor Oberth as the man mainly responsible for the final development of the flying bomb. He was a sound and scenic-effects technician who created explosive pyrotechnic displays for German UFA films.

As far back as 1931 Professor Oberth made giant long-distance rockets his pet hobby. Of one in particular, he calculated that from Berlin it would take 24 minutes to travel to New York, 11 minutes to Moscow and only six minutes to London. For the past seven years he has been working on rocket-firing and flying bomb techniques on special orders of Hitler and Goering.

The regions around Schleswig-Holstein and Peenemunde, in northern Germany were the first in which demonstrations of the flying bomb were made by Oberth early in the war. Later he moved his contraptions to some French laboratories and trials took place in the Forest of Fontainebleau, near Paris.

With the fall of France, flying bomb launching platforms, storage houses and conveyor systems were constructed in the Pas de Calais area across the channel from Britain. The ramps are built in series of four, well concealed in woods, most of them only a short distance inland from the coast. Other installations have been noted in Abbeville, Boulogne and points adjacent.

Repeated and full scale blitzes by all types of Allied planes are systematically demolishing these launching ports or "pilotless aircraft emplacements" as they are known officially. *Marauders* and *Havocs* have chalked up a sizable score while a devastating succession of blows have been struck by *Fortresses* and *Liberators*. *Mitchell* and *Boston* crews have pinpointed many of the targets. *Mustangs* and *Typhoons* constantly dive-bomb the installations.

According to Jean Paquis, in his announcement on Paris radio recently describing how a flying bomb lair looks, "the runway for flying bombs is approximately 120 yards long and 20 yards wide.

"At one end stands a small one-roomed building with glass walls in which German officers sit round a large table, with a detailed map of southern England. The officers fix the targets and give orders by a loudspeaker to the men who operate the send-off."

In his report of July 6, Prime Minister Churchill stated: "In my opinion, and in the opinion of my advisers, between 100 and 150 flying bombs, each weighing about a ton, are being discharged daily . . . In all, up to 6 a. m. this morning, about 2,750 flying bombs have been discharged from launching stations along the French coast. A very large proportion of these either failed to cross the Channel or have been shot down or destroyed by various methods, including great deployment of batteries, aircraft and balloons which have been very rapidly replaced."

One counter-measure, once the flying bombs take to the air, is found in fast fighter planes. Pilots of the pioneer *Mustang* group of the Ninth Air Forces Fighter Command have shot down several. *Thunderbolt* pilots have destroyed others. *Spitfires, Mosquitoes, Tempests* and *Typhoons* in the hands of RAF veterans have reported many interceptions.

Pilots who go hunting the flying bombs hover around likely areas of passage and give chase as soon as one is spotted. Once they have picked them up, they can follow them fairly accurately as their course cannot be altered except by high winds. This accounts for a number of "kills" by antiaircraft fire, and forced landings which have been harmlessly exploded in empty fields.

I have watched pilots ride in at the bombs on an angle and drop their target with only one burst from their machine guns. By sheer skill and cast-iron nerve a pilot diverted one of them headed for an inhabited area. Flying close in he tipped the wing of the flying bomb by contact with his own.

Such a freak weapon will never win this war, but in the meantime churches, schools, hospitals, shops and homes will continue to be hit.

The British consider the bombs indiscriminate murder. END

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BOMBERS ACROSS

The Story of the Transatlantic Ferry Command

by CAPTAIN EDGAR J. WYNN

Introduction by LOWELL THOMAS

E. P. DUTTON

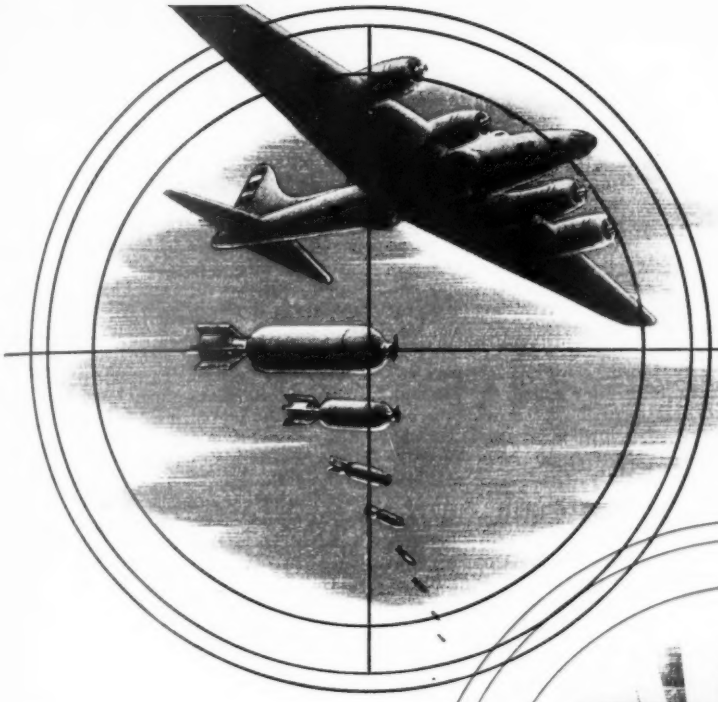
Report from Washington

(*Continued from page 52*)

per the public right to fly and impose additional and unnecessary costs on the flying public . . . Aviation students and airplane purchasers are discouraged rather than encouraged . . . A code of best practice is suggested to replace the should-and-must type of regulation now in force. Under this code, regulations covering maintenance would be redrafted so that the airplane owners would bear no greater burden than the automobile owner; a pilot would receive a pilot's license with no greater relative difficulty than in securing an automobile driver's license; learner's permit would be granted to students without undue formality; no medical or physical qualifications above those of major importance would be required; any individual holding a pilot's license could give instruction providing he does not do it for hire or reward, and a student passing a simple and realistic flight test would be certified . . . Whatever the suggestions, it is obvious that a sane and sensible relaxation of regulations and restrictions must be accomplished if we are to welcome anything which approximates the air age as far as personal flying is concerned. The personal flyer has been lost in the shuffle during the past few years and he must be given the right to fly which, in many respects, has been taken from him by these onerous restrictions."

More Regulations

But more regulations, rather than fewer, seem to be indicated by a recent move at CAA to assimilate war flyers into post-war civilian flying. Regulations already on the books require that if a returned pilot has not flown the type of private plane concerned within three months, he must make five take-offs and landings before taking up a passenger. If he has been six months without soloing, he must check out with an instructor . . . Commercially, the rules are even more stringent, requiring proof of a matching military rating, a Civil Air Regulations written exam, and an honorable discharge plus a certificate proving the applicant's skill as a military pilot. He must then get by even stiffer airline requirements . . . CAA adds that there will be relatively few commercial jobs wait-



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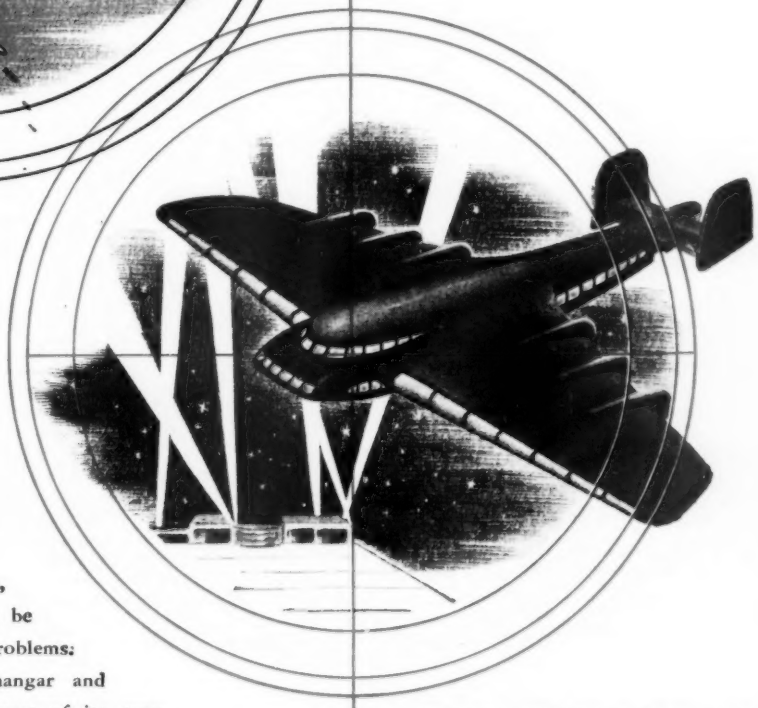

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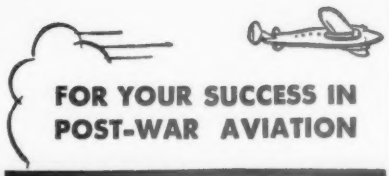

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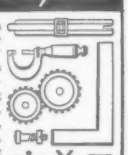

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ing for returned military pilots, even if pre-war transport activities multiply many times.

Leaflet Bombing

During the opening days of the war, British planes flew over Germany and dropped leaflets. It was not until it became obvious that the Germans could not be talked out of fighting that bombs were used. Later, leaflets disappeared from the news and few realized that the work has continued, until now it has reached sensational proportions. Washington experts reported recently that leaflets are being made ready "in quantities of about 11,000,000 a day in Great Britain and that quantity probably will be increased to some extent in the very near future . . ." The story is that for a time the problem was getting aircraft, but now there are plenty of spare planes available for the propaganda job. These have recently been formed into a special squadron which does nothing but leaflet work . . . From England also comes a new footnote on the Battle of Britain. Gloster Aircraft officials report that during the height of the battle they turned out a *Hurricane* every four hours and a *Hurricane* that left the factory on, say, a Saturday, was fighting the following Thursday . . .

Flying Watermelons

Little has been said except in passing of the development of streamlined, metal "watermelons"—auxiliary tanks which have been devised to extend the range of U. S. fighter planes so that they can protect bombers in the long runs to Germany. They have proved equally helpful in getting planes delivered, not only to the European fronts but also to Russia, via the Alaskan route . . . Reports from Orlando, headquarters of the AAF Tactical Center, say that the tanks have enabled bomber-escort fighters and fighter-bombers to reach "practically every corner of Fortress Europa." They have also enabled reconnaissance planes to fly great distances and photograph ground installations . . . Tactical Center experts predict that the flying watermelons will also be a highly effective factor when our fighters can operate over Japan.

Gremliars

E. A. Tegler, of Philadelphia, protests that the following story is not original with him and is already a twice-told tale among a lot of flyers. But we pass it along if for no other reason than it gives us the opportunity to nominate him for the Loyal Order of Gremliars: In the early days of the war, Civil Air Patrol pilots were constantly dogged by civilian questions about what kind of bombs (if any) they carried to attack submarines. The pilots finally came up with a stock answer—they carried green-paint bombs. They'd drop a green-paint bomb on the periscope of a submarine, whose commander, thinking he was seeing water, would order the sub to surface. The sub would then rise into thin air, where lightened atmospheric pressure would cause it to explode . . . Speaking of subs also gives us opportunity to pass along a yarn told us recently by Jim Strebig, Washington Associated Press aviation expert. A Navy patrol bomber in the Atlantic recently got a hurry call from a destroyer being attacked by two submarines. The bomber rushed to the scene, only to find an unworried destroyer—and two oil smears. The subs had fired on the destroyer from its port side and its starboard side simultaneously. The destroyer got out of the way and the torpedoes went on to blow up both of the subs. If anyone doubts this, Jim has two small bottles of oily salt water picked up by one of the destroyer crew . . .

Briefings

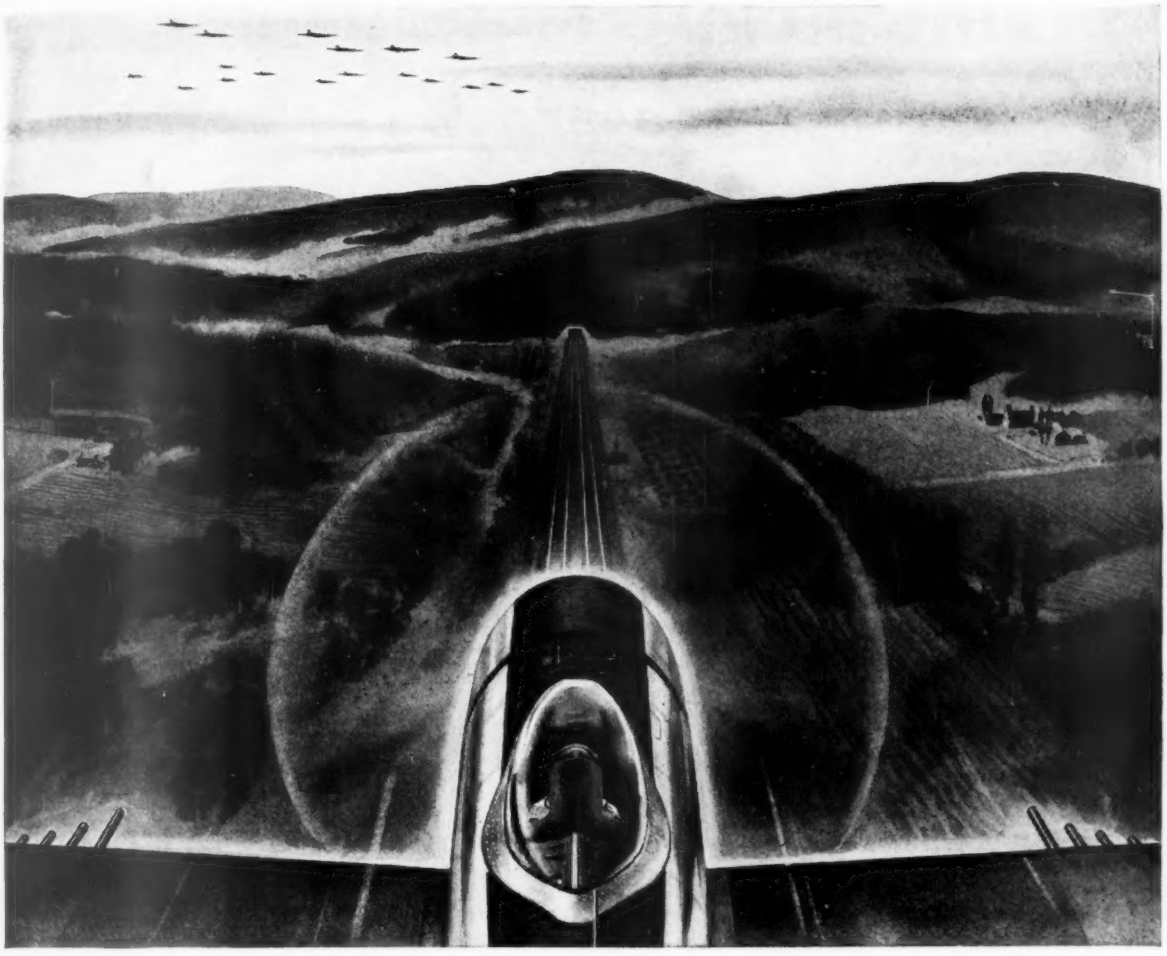
The U. S. mission just returned from Spain was one of the most impressive delegations of Federal civilian aviation experts ever sent out from this country. Among those who went were CAA Administrator Charles I. Stanton, CAB Member Oswald Ryan and Fred Bovinger, chief of air carrier inspection in Region One of CAA, with headquarters in New York. . . Purpose of the visit was to work out technical details following Spain's granting of landing rights to the U. S. as well as Britain. . . Following the continental rendezvous, it is understood, as this goes to press, that Mr. Stanton and Mr. Ryan will also visit London. . . While the visit to Spain was under State Department auspices, the London visit will be informal . . .

Will the Nazi's flying bomb have a peacetime application for private flying? In this issue, Kenneth R. Porter quotes F. G. Miles, British aircraft designer, as estimating the total cost of the robots at from $2,000 to $4,000. At that rate, jet engines, which are but a small part of the flying bomb, might be within the reach of middle-class pocketbooks . . .

Whether they know it or not a great many small-town Americans have a close tie-up with the world air routes that the United States has built to help win the war. CAA airway installations now scattered to the four corners of the earth to guide fighting planes toward their goals were transplanted from such towns as Montpelier, Vt., Sault Ste. Marie, Mich. and Aberdeen, S. D. . . . The installations were moved from their former small-town sites to far points of the world by the combined efforts of the Navy's Seabees, the Army, and CAA. There are 204 of them now in operation outside continental U. S., 70 manned by CAA personnel . . .

Mexico City is building one of the largest and best-equipped airports in the world. According to word reaching Washington, the port will have an area almost twice that of La Guardia, New York, with five runways of from 5,700 to more than 8,000 feet. Main runways will be 130 feet wide. It will be called Aeropuerto Central . . . By the end of 1944 there will be more than 2,100 civil airports in operation in the 20 other American republics . . . And from Oregon we learn that two civilian pilots, Floyd Capps and Oscar Davis, in 35 days killed 278 coyotes to earn $2,432—hunting from a putt-putt . . .

—FRED HAMLIN



THUNDERBOLTING THE GATES

IN a matter of seconds, this Thunderbolt pilot will plant two half-ton bombs smack in the throat of that tunnel ahead—bolting the gates against enemy reinforcements.

This and similar Thunderbolt "buzz-bombing" tactics are today in regular use on all fronts, providing powerful precision "artillery" that paralyzes enemy movement by blasting bridges, viaducts and railroads many miles behind the lines.

With its eight 50-caliber machine guns, the Thunderbolt has also proved highly efficient at scrambling ground targets . . . riddling locomotives, troop trains, flak towers, ships and anything else that impedes our march to Berlin and Tokyo.

This work, you may say, is a far cry from the high altitude bomber-escort job for which Republic Thunderbolts were originally designed and at which they are still busily engaged. But Army Air Forces pilots, aware of the plane's versatility, evolved techniques by which it fights as effectively and ferociously on the "deck" as at seven miles high.

Thunderbolt pilots are in truth hitting the enemy *wherever* they find him—high or low, near or far.

Republic Aviation Corporation, Farmingdale, Long Island, N. Y., and Evansville, Ind.

* * *

Republic *firsts* in war point to *firsts* in peace

"DECK" WORK!

In 30 days, a single Thunderbolt group operating at low altitudes—"on the deck"—accomplished the following tasks (*from a War Department release*):

Cut enemy rail lines in 201 places. Destroyed six tunnels, ten railroad bridges, 178 railroad cars. Set 226 motor transports afire. Blew up 17 ammunition dumps. Destroyed radio station and high-tension tower. Silenced four ack-ack posts, three machine gun positions. Set 34 buildings and warehouses afire. Destroyed 11 enemy planes on the ground. Sank two barges, damaged six landing craft.

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So, while we are now 100 per cent engaged in war work, we have discarded our old courses, and have answered all inquiries with "Sorry, no more enrollments till after the war."

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We've still a few of our 64-page illustrated catalogs. They're obsolete in some respects, but contain much information you'll enjoy about piloting, engineering, mechanics, etc. No obligation, no charge. The book is *free*. Send for it today.

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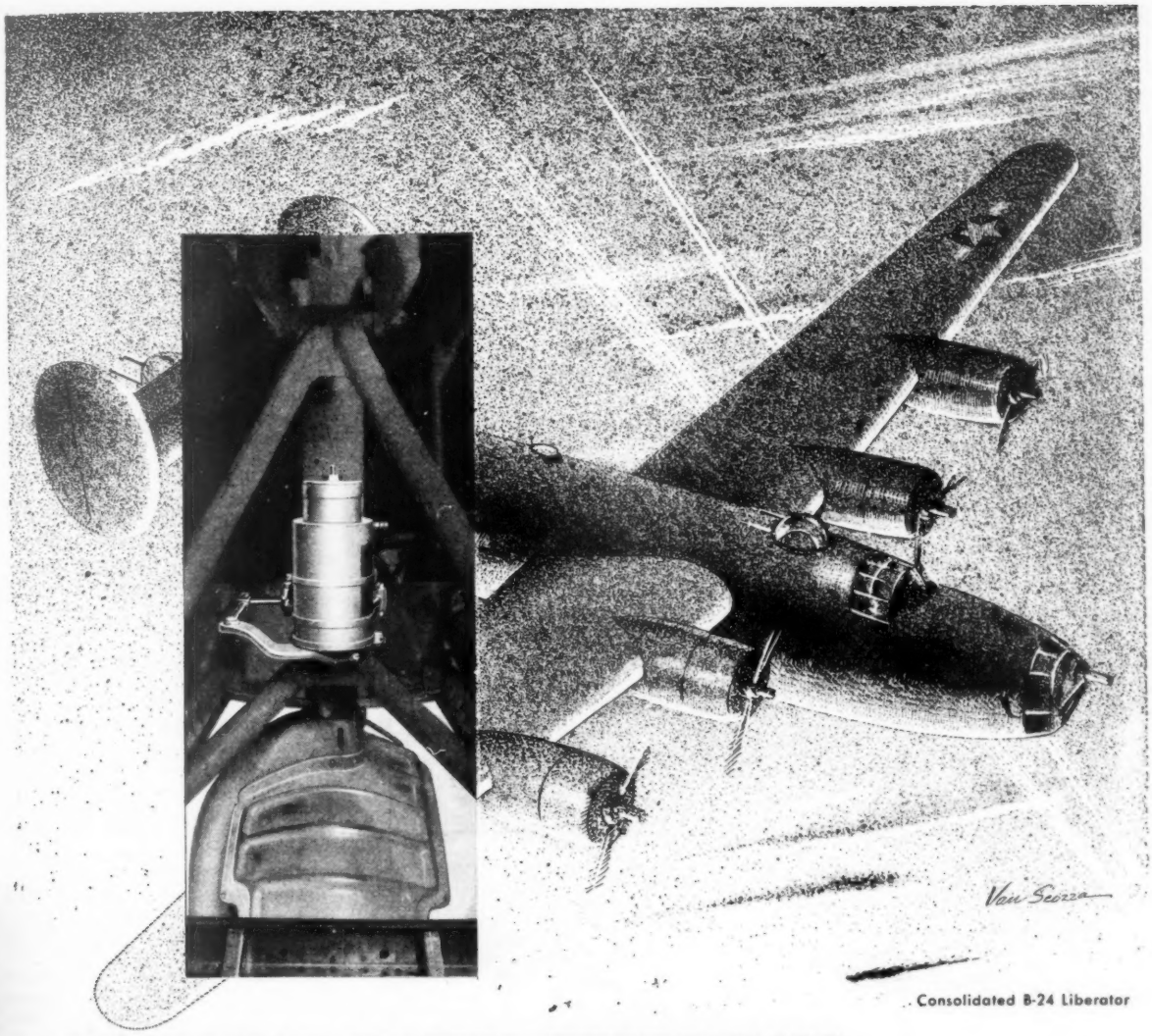

Consolidated B-24 Liberator

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Houdaille Hydraulic Instruments have served TWO world wars and scores of peace-time applications.

They have cushioned and controlled the recoil of French 75 mm. guns, the snap-back of railroad switch frogs, the swing of the huge jaws of 20-ton steam shovels, the lurching of high-speed railroad trains, the spring action on millions of motor cars and trucks . . . and, now, the shimmying of nose and tail wheels on fast landing fighters, bombers and cargo planes.

In times of peace ahead, Houdaille engineers again will apply their vast experience and knowledge in this highly specialized field to many new problems.

● The Hydraulic Shimmy Damper is only one of the products which Houdaille-Hershey is producing in quantity for the aviation industry.

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*Pronounced — Hoo-dye

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Atlantic Crossroad

(*Continued from page 57*)

and development of the field even before the war.

The company was formed in 1936 by Group Capt. D. F. McIntyre, of the RAF, and the Marquis of Clydesdale (now the Duke of Hamilton), who are famed as the first men to fly over Mount Everest. Residents of Ayrshire, they felt it should be the site of an airdrome because its fog-free weather permits flying about 360 days a year. SAL originally operated a civilian flying school on the airdrome but by the outbreak of war was training pilots, observers, navigators and radio operators for the RAF.

After Dunkirk, when Britain desperately needed more aircraft than limited shipping space and the U-boat toll made available from the U. S., the government decided to attempt ferrying planes from Canada. Prestwick, because of its favorable weather conditions and its location on the west coast, was chosen as a British terminal. The ferrying service was originally organized with civilian crews by Canadian Pacific Railway. The first Lockheed *Hudsons* took off from Newfoundland on Armistice day, 1940.

Ten hours after take-off, when the first of the squadron arrived at Prestwick, the duty pilot thought his leg was being pulled when the pilot said he had come from Canada. When asked if he was the first of the few, the pilot replied, "No! The first of the many!" The organization of which he was a part later became the RAF Ferrying Command, comprised largely of U. S. civilians, and is now the RAF Transport Command, a mixed organization of civilians and Empire servicemen. The difficulty of returning ferrying crews to America was resolved when British Overseas Airways Corp., subsidized by the Air Ministry, went into scheduled transatlantic operation, hauling the crews as the principal component of its westbound traffic.

Even while Pearl Harbor was a memory measured only in days, the U. S. was planning the use to which it would put Prestwick. Late in December, 1941, one officer and 15 enlisted men were stationed there as observers. But it was months before the first planes with the white stars flew in over the ocean.

The first visit by an American army transport was on April 18, 1942, when a *Stratoliner* flown by a TWA crew popped in from Washington, carrying top-ranking military passengers. The big Boeing, designated C-75 when it donned olive drab paint, was destined to return again and again. A year later, highly trained ground personnel from two airlines and a full U. S. military establishment, under command of the newly activated European Wing of the Air Transport Command, were operating an astonishing number of overseas flights with the nonchalance of veterans.

Ever since the first *Hudson* from overseas touched the ground at Prestwick, the story has been one of more and more, bigger and bigger, faster and faster. The growth of Prestwick parallels the aircraft production curve and the Technical Training Command's output figures.

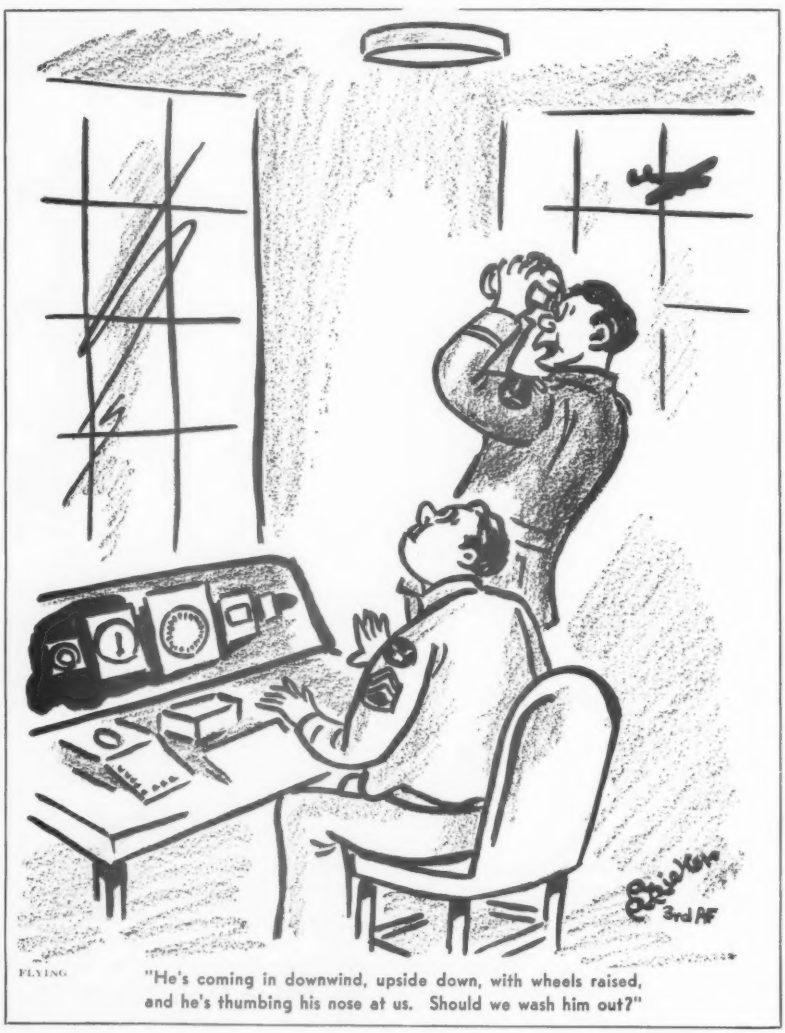
As the numbers of flights increased, so did the number of RAF and ATC personnel, which required the construction of many Nissen and Seco huts to house them. More area had to be acquired for parking space. More hangars had to be built for maintenance and modification. More offices were needed, so additions were made to the terminal building. The AAF reached out and claimed Adamton, formerly a private estate then in use by RAF personnel, and made of it an officers' club and station headquarters for the U. S. forces. Concrete was poured for runways, taxi strips, parking areas, roads, walks, foundations for new buildings. The airport is still experiencing growing pains.

But the traffic in combat aircraft for the British and American air forces has swelled to such proportion that no single airport can cope with it. The European Wing has acquired other airfields which now handle a large proportion of the deliveries and even a share of the transport operations.

Aside from transoceanic traffic, Prestwick sees a large volume of internal flights. The Air Transport Command and Eighth Air Force operate scheduled services to airfields in the British Isles, using *Skytrains* and *Lodestars*. The delivery service to operational bases by British-based AAF ferrying squadrons contributes a sizeable number of flights to the total. The RAF conducts a number of projects at the field and a small Scottish airline makes Prestwick a regular port of call. It is a major stop for Britain's Air Transport Auxiliary, a semi-military organization ferrying combat planes within the United Kingdom. The airdrome's traffic would be fair competition with that of pre-war LaGuardia Field, which boasted the world's busiest airport.

When British press men first visited the airdrome with permission of the Air Ministry last March many of their dispatches dwelt on the position of Prestwick in post-war world aviation. Many correspondents gave their opinion that it

(*Continued on page 140*)



FLYING "He's coming in downwind, upside down, with wheels raised, and he's thumbing his nose at us. Should we wash him out?"

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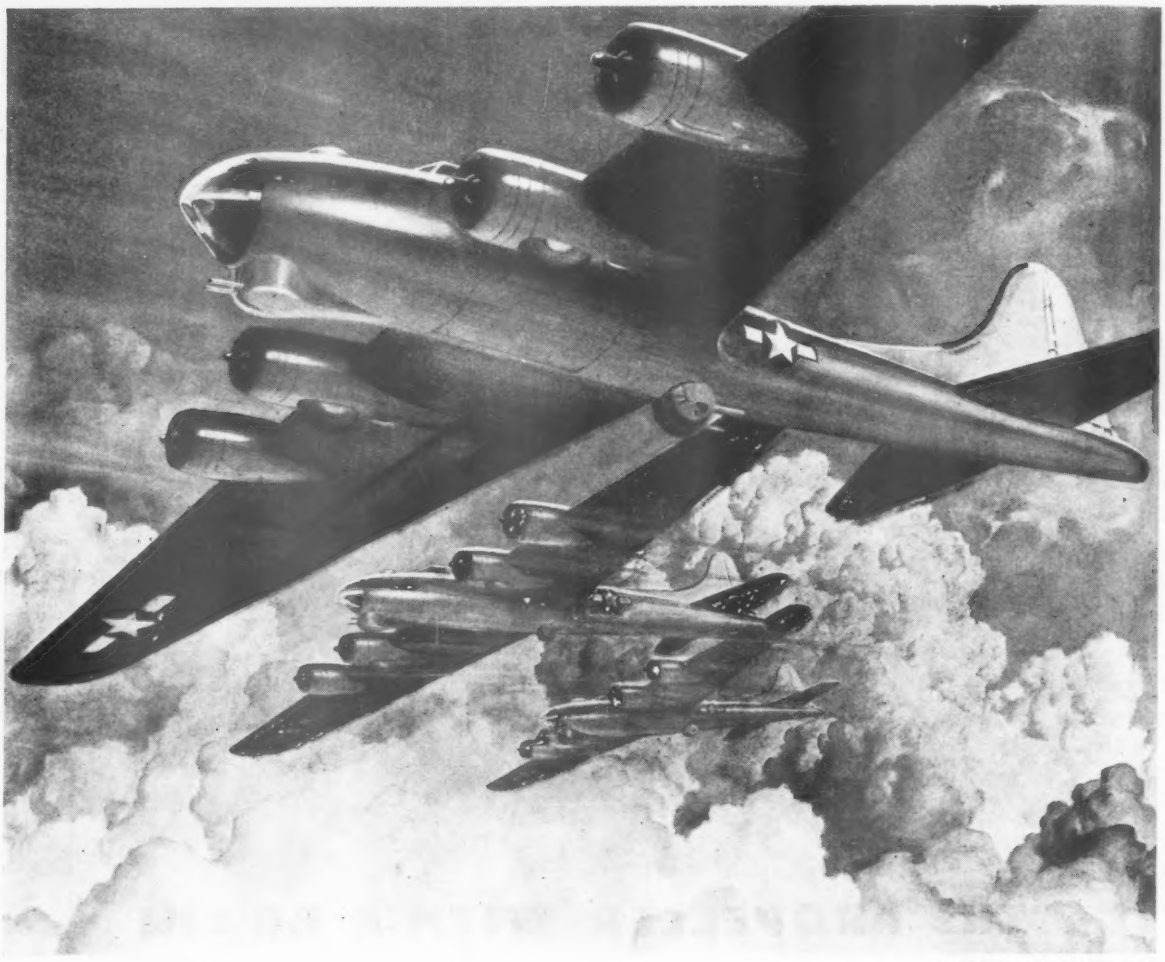

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617 combat hours for Studebaker-built engine 43-58319

As great armadas of Flying Fortresses swarm across invaded Europe, the squadron engineering officer of an Army Air Forces base in England has revealed that engine number four in the Fortress "Miss Carry," some time ago completed 617 combat flying hours.

"This engine's performance," said the officer, "exemplifies war-winning co-operation at its best. The workers in the factories back home produce the world's finest equipment. Our ground crews work day and night to keep that equipment in operational trim. Our combat crews do an outstanding job in blasting enemy targets and knocking out the Luftwaffe."

Studebaker has already built more than 40,000 of the mighty Wright Cyclone engines that power the famous Boeing Flying Fortress.

But the entire Studebaker organization fully realizes that this war is being won, not by production statistics, but by men in combat all over the world—on the ground, on the seas and in the air.

It's those valiant Americans in action of whom the workers in the Studebaker aircraft engine and military truck factories are thinking constantly.

Awarded Studebaker Aviation Division

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Proud to be of service to her country

And all America, in turn, is proud of every member of the Women's Army Corps. Many more women from 20 to 49 inclusive are needed. Encourage WAC recruiting.

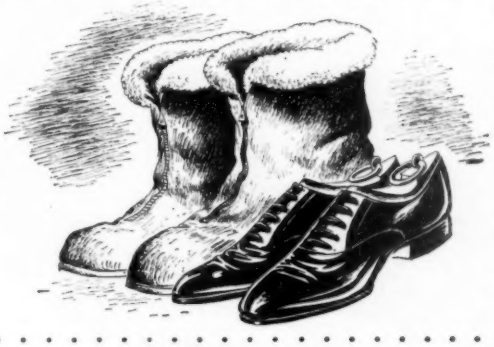
★ *BACK THE WOMEN'S ARMY CORPS* ★

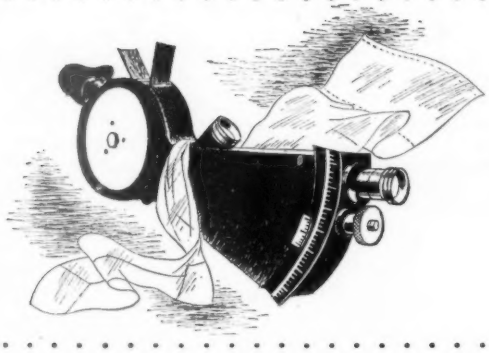
Studebaker BUILDS WRIGHT CYCLONE ENGINES FOR THE BOEING FLYING FORTRESS

They wouldn't fly without them...

Mascot of a Fortress crew who never flew without him, this Scottie had his own oxygen mask and parachute. On duty at Pearl Harbor December 7, at the Battle of Midway and the Guadalcanal campaign, he logged over 800 flying hours.

A pair of patent leather dancing slippers always decorated the feet of a co-pilot who had worn them on his last civilian date. They went on many a mission over Germany, worn under his flying boots.





A careful navigator used one of his best girl's nylon stockings to wrap around the lenses of his precious octant.

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ETHYL is a *trade mark* name

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Kit T73, "Spitfire"; Kit T74, Messerschmitt ME-109; Kit T76, "Airacobra"; Kit T77, "Warhawk"; Kit T78, "Hurricane"; Kit T85, "Lightning"; Kit T91, "Mustang"; Kit T99, "Typhoon" (illustrated); Kit T105, "Whirlwind."

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(*Continued from page* 136)

will be the principal British terminus. They pointed out that Prestwick is one of the few locations in the Kingdom which is almost always above instrument-landing weather minimums, and that it is conveniently located on the west coast for the short northern route over the Atlantic, and that it could, therefore, not be replaced in southern England.

The opinion of experienced U. S. airline men is far from unanimous. The fact that Prestwick is an overnight train ride from London, probable destination of most post-war travelers, makes it almost as far from London in hours as it is from New York. Although weather in the London area is notoriously poor for airline operation, the London proponents point out that our bombers don't find that a hopeless handicap. Then too, they add, reliable radio aids now being used for purely war purposes may permit almost "blind" landings and take-offs by commercial aircraft, in peacetime.

Time alone can settle the argument, but nothing can now obscure the amazing role in which Prestwick has starred. No one can now rate the relative values of one factor or another in winning the war. But one thing is sure: Prestwick will not be forgotten. END

Transport Blinkers

(*Continued from page* 53)

tion industry, is in immediate charge of this development.

As in many flying problems, several of the solutions were found on the ground, and the experimental work seemed far removed from the business of flying transport planes at night. The laboratory set-up utilized a building in the Bureau of Standards group and the clock tower at the Soldiers' Home, three and a half miles away. Connected by telephone, the scientist observers in the clock tower directed the work of technicians on the roof of the Bureau building.

When night flying began in the 1920's, each pilot (or airline) equipped planes with lights as they pleased, with individual safety of the pilot almost the sole consideration.

Aircraft lights were standardized in 1927, under Air Commerce regulations based on marine lighting practices. Planes were required to carry a constant white tail light and constant red and green lights on left and right wingtips respectively. There also was a provision that transports be equipped with adequate landing lights as well as signal lights, such as the Very pistol.

There's a vast difference between 1944's airline night flying and that of 1927. The number of night schedules has increased greatly and the cruising speed of planes has almost doubled. Concentration of planes in the vicinity of large terminals has multiplied.

The main problem was to make the airplane lights conspicuous and to make them so distinctive that they would never be mistaken for stars or lights on the ground when viewed from another plane in flight, or for ground lights while taxiing.

The objectives had to be attained without seriously increasing power consumption, with a minimum of additional weight and radio interference and with a design easily adaptable to existing airplanes.

Ground observations at the National Bureau of Standards were conducted to determine the number and color of lights to be used; whether they should be constant, modulated or flashing; the optimum timing of flashes or modulations, and the types of flasher mechanisms to be used.

Flight observation tests followed at the CAA experimental station in Indianapolis, and at New York and Washington with American Airlines co-operating. Many of the ground experiments, while supplying valuable data, proved inconclusive in the solution of the problem when we encountered the visibility problems aloft. After scores of tests, we found what seemed to us and to observers and experts from the aviation and lighting industry the best possible answer to the problem.

The now familiar lighting system used on air-carrier aircraft in the United States consists of a red and a white light on the tail and red and green wing tip lights, all flashing at the rate of 40 cycles a minute. The time of flashing is as follows: red light on .625 seconds, followed by a period of darkness of .208 seconds; white light on .625 seconds, followed by darkness of .042 seconds.

When the tail lights change from red to white, there is a tendency to blend, and a pinkish light results. That accounts for the longer period of darkness or cut-off between the red and white. However, when the red follows the white there is less tendency to blend, and the cut-off time can be reduced to .042 seconds.

The CAA requires only that the tail lights flash, but the effectiveness of the system has been recognized by the airlines and general practice today is to flash wing tip lights as well. In addition airlines have placed a white light on top of the fuselage and another white light below, flashed in rhythm with the red and white tail lights.

Several flasher mechanisms were investigated. These included motor-driven devices developed by the Union Switch and Signal Company of Swissvale, Pa.; Wallace and Tiernan Products, Incorporated, of Belleville, N. J.; Bendix Aviation, Ltd., of Hollywood, Cal.; a thermal-type flasher developed by the Tung Sol Lamp Works, Incorporated, of Newark, N. J. Valuable contributions, including the development of a tandem arrangement, were made by Charles Adler, Jr., of Baltimore. To date the Wallace, Tiernan and Bendix devices have been approved for use on certificated aircraft. They require very little power for operation and maintain the flashing program efficiently.

Any plane you see overhead at night with flashing lights as described above is a U. S. air carrier in domestic service. However, a plane without these lights is

(*Continued on page* 144)

THE FOURTH REASON....

The men and women of Hallicrafters Company are proud to receive the Fourth Army-Navy Production Award. It is a Fourth Reason, a Fourth Incentive, to continue to produce the most and the best that those at the fighting fronts all over the world shall not have "too little, too late." With deep humility and with the realization that to produce is the least that can be done for those who fight, the people of Hallicrafters accept this award.

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THE FIRST EXCLUSIVE RADIO MANUFACTURER TO RECEIVE THE "E" AWARD FOR THE FOURTH CONSECUTIVE TIME

How We Must Use Air Power

(*Continued from page 23*)

forces into two parts, one to attack the Japanese armed forces, and the other to bomb lines of communication.

Our Marine and Army infantry divisions landed on Saipan with the heaviest concentration of fire from Naval artillery and carrier-based planes, to which was ultimately added the fire of their own artillery. All this fire first furnished a preparatory fire and then an accompanying fire. When part of the Japanese fleet was reported to be advancing towards Saipan from the west, and its carrier-based planes attacked our Naval forces, our carrier-based planes plus the fire of the guns of our warships drove off the Japanese planes with heavy loss to them. By the next day our carrier-based planes had located the Japanese fleet, and our ships and planes attacked it at dusk, causing considerable loss in ships and planes. The Japanese fleet then retreated. Our ships, instead of following the Japanese and thus taking them out of reach of the Saipan fighting, returned to Saipan and continued the use of their planes and Naval artillery to help advance our troops on the ground.

In analyzing what has happened in these operations and in other combat operations of this war, several assumptions on which our aviation is operating should be re-examined:

1. The Douhet theory, already mentioned, which is largely followed in the European theater.

2. That airpower can effectively isolate the battlefield so that the enemy cannot bring up reinforcements of troops, guns and tanks, and the food and ammunition necessary.

3. That strategic bombing can, in itself, be the decisive factor in the war, and that we do not need overwhelmingly large ground forces.

4. That the battleship has been made obsolete by airpower and carrier-based planes instead of the fact that without battleship support the carriers cannot operate.

Our operations in the Pacific are being conducted on the Napoleonic principle. In following this principle, land and sea-based aviation, the fleet, and ground troops are being used as parts of a combined whole whose objective is to destroy the enemy's armed forces in battle.

Our carrier and land-based aviation, while used for strategic bombing between battles, is always present during battle to support the sea and ground forces directly.

In Europe, on the other hand, our aviation is being used as the dominant force, with the ground troops and sea forces playing an auxiliary part. The tendency is towards the Douhet theory that the ground and sea forces play a subordinate part to the strategic air forces. This force is virtually independent of the ground forces because it is primarily concerned with smashing the factories, refineries and lines of communication in the rear, instead of being used to advance the ground forces by destroying the enemy's troops opposing them in battle.

A comparatively small number of skip and dive bombers give really direct support to our ground troops in action. With this exception, the tactical air forces assigned to the so-called direct support of our troops are primarily concerned with attacks on the enemy's aviation and on the road and railway network in the rear of the battlefield in an effort to isolate it so that enemy reinforcements, ammunition and supplies cannot reach that battlefield.

After Guadalcanal, in the capture of which we made many mistakes, our Pacific theater record shows a steady improvement, with success after success in a relatively short period of time. From Tarawa to Saipan; from New Guinea to Numfor, the forces of General MacArthur and Admiral Nimitz have gained victory after victory.

In Europe and the Mediterranean area, though we landed in North Africa in November, 1942, a year and eight months later we have not yet cleared the Germans out of Italy. In Normandy, more than a month after we landed, we had only gained the Cotentin Peninsula, and had made no worthwhile gain on our left. Instead, we were being counter-attacked by the Germans along practically our whole front.

An examination of the combat to date in both theaters of war shows this difference in the time and rate of advance toward victory to be primarily due to the fact that the Napoleonic theory of concentrating all arms against the enemy's armed forces for the purpose of beating them in battle brings results which cannot be had when Douhet is followed in whole or in part.

"Fire is everything. The rest is nothing." Even those most determined to throw out all past military history as being valueless, because aviation didn't exist, cannot counter this maxim of Napoleon, because the airplane is simply a new means of delivering fire.

Therefore, the principal question is: Where can the delivery of this fire do the most damage to the enemy and thereby insure his decisive defeat in the minimum time?

In the Pacific, the maximum amount of fire is delivered in the minimum amount of time on the enemy's armed forces, which are trying to defeat our armed forces in battle.

In Europe, the maximum amount of fire of ground troops is delivered upon the enemy's armed forces. Our field artillery has a system of concentration of fire which German prisoners say is more ferocious than anything encountered elsewhere, including the Russian front. General Montgomery, who commands the forces landed in Normandy, is a great believer in artillery concentrations of fire, and such concentrations were primarily responsible for his victory at El Alamein.

The primary targets for the greater part of our aviation in Europe and the Mediterranean area have not been the enemy's armed forces, but so-called strategic targets such as factories and railway centers far to the rear of the battlefield.

The fire from aviation in all our landings has been primarily directed against targets in the rear of the landing battlefield rather than upon the German and Italian troops directly opposing our ground forces.

Thus, while in the Pacific, the attacking ground troops have the direct benefit of the combined fire of their own artillery, plus that of a large Naval force and all the aviation, either carrier-based or land-based, or both, which can be concentrated against the enemy's armed forces opposing them, in the European area our attacking troops so far have had their own artillery, but only a limited Naval artillery support and the support of but a fraction of the aviation available.

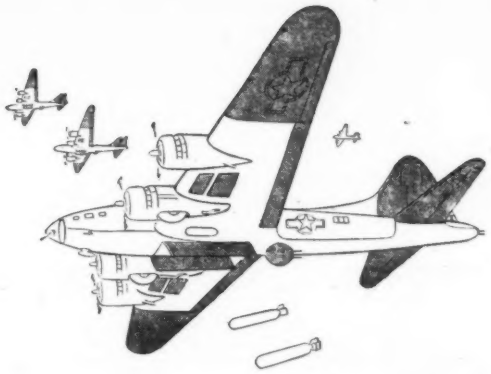
The fire used in an attack of ground forces must consist of two parts if the attack is to succeed: The first is the "preparatory fire"—to smash up the enemy's position as much as possible and to drive its defenders down into their holes from which they cannot fire on the attacking troops. Secondly, there should be an accompanying fire which begins as soon as the preparatory fire ceases. This fire should have the greatest depth possible with the number of guns and airplanes available to deliver it. It should move forward as the attacking infantry goes forward, thus keeping the defenders in the holes to which they have retreated to escape the preparatory fire. Its nearest edge to the attackers should be at about 200 yards, as that does not endanger them from the fragments of the smaller shells which are used for the part of the accompanying fire closest to the attacking infantry. The heavier guns furnish the more distant part of this fire because their shell fragments cover a greater distance than do the light guns. Bombing planes should be assigned that part of the accompanying fire which is far enough forward to make the attacking infantry safe from their bomb fragments and their inaccuracies. The latter are far greater than in the case of artillery.

This belt of accompanying fire, moving forward at the same rate as the attacking infantry advances, enables that infantry to reach the holes in which the enemy's infantry, machine guns and mortar crews have hidden before they can come out and man their weapons to stop the attack. Without this accompanying fire, the attack generally fails, with high losses.

It was the lack of such accompanying fire which caused such heavy loss to the Marines when they captured Tarawa. The island being flat and only a few feet above the surface of the sea at its highest point, the flat trajectory Navy guns could not furnish an accompanying fire within 200 or 300 yards of the Marine infantry. At short ranges, the projectile of such flat trajectory guns travels in such a straight line from the gun to the target there was danger of hitting our Marines.

What was needed was the Army artil-

(*Continued on page 152*)



BRIGGS REPORTS

on One Billion Dollars in War Orders

—and how the money is being spent

During peacetime, Briggs Manufacturing Company is the Nation's largest independent automobile body manufacturer. In the war Briggs is devoting its peacetime skill to making bodies and parts for medium tanks and aircraft; also, bomber turrets, droppable gas tanks and non-ferrous castings.

Briggs war orders total approximately $1,000,000,000. This money has been spent or is being spent as indicated in the box shown herewith. Percentages are based on distribution of Briggs 1943 sales dollar.

53.6%	to about 40,000 employees for wages and salaries.
0.2%	for executive salaries.
32.1%	to some 2,000 subcontractors for materials, supplies and assemblies.
1.9%	to stockholders for dividends.
9.2%	for taxes.
1.2%	for depreciation.
1.2%	for reconversion expenses and other costs arising from the war.
0.6%	left in the business.

In 1943 Briggs did twice as large a dollar volume of business as it did in an average peacetime year. In 1943 Briggs delivered double the number of tank hulls delivered in 1942. In the same year Briggs delivered to the U. S. Army and Navy more than 22,500,000 pounds of airplane sections, as compared with 7,000,000 the year before. This included almost twice as many bomber fire-power turrets as in the previous year. Total shipments to date of airplane sections by Briggs exceed 45,000,000 pounds.

Earnings by Briggs hourly paid employees in 1943 averaged $3,159.00. On December 31, 1943 there were 39,312 people on the Briggs payroll, of which 21,737 were men and 17,575 women. This is 48% greater than on December 31, 1942 when Briggs payroll was 26,401 people.

In the first five months of 1944, shipments of airframe sections, by Briggs, were at considerably greater monthly rates than during any other months since the war began. Production of tank hulls was almost equal to the 1943 rate. Deliveries of auxiliary gas tanks, for the first five months of this year, were 7 times the total for 1943, and shipments of aircraft fire-power turrets were at a rate almost twice that of last year.

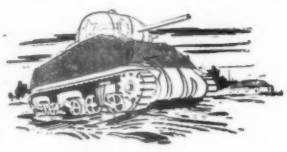
Unless very extraordinary developments take place, Briggs 1944 war business should be equal to, or exceed, its record 1943 year.

During the war, Briggs has shown that experience in manufacturing good automobile bodies, plumbing ware and non-ferrous castings has enabled it to turn out good "bodies for bombers, fighters, tanks" and other war requirements. Briggs is glad that it has been able to play an important part in the Nation's war effort. All of its facilities and energies will continue to be available to the Armed Forces until Victory has been won.

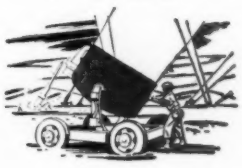
However, when Victory does come, Briggs is prepared to go about the job of reconversion with the same dispatch and intensity that it applied to the preparation for war, and, if it is allowed to do so, can go back into at least some peacetime production quickly.

W. O. BRIGGS
Chairman of the Board

W. P. BROWN
President



BRIGGS MANUFACTURING COMPANY
DETROIT



(*Continued from page* 140)

not necessarily violating CAR 15.2015. In these days of ocean flights, it may be a friendly foreign plane, for, while our lighting arrangements had international approval, there will be no opportunity until after the war to internally standardize the new devices. On the other hand that plane may be privately owned. We are still working on the problem of private aircraft. The question here is that of getting something inexpensive enough for a private pilot to afford, and lightweight enough for his plane to carry without impairing performance.

We now are experimenting with a forward light which may prove more effective than the flashing light. This light will direct a beam forward, and a movable reflector in the light unit will swing this beam to the right and left through an arc of about 90°. The same sort of light may be useful on the tail of transport planes.

The CAA's Technical Development Division is not regulatory. It is a practical group of engineers whose work is utilitarian. The division develops something at the request of the industry or in answer to an obvious aviation need; if the development functions properly and is practicable, it is taken over by the industry and put to work. This was the case in the development of the flashing lights and they proved so successful that a regulation was drawn to make their use mandatory on air carriers. END

Ralph S. Damon

(*Continued from page* 27)

growth of our country depended upon one solitary railroad. Such a stimulus of competition must always be present if there is to be proper opportunity for growth.

That a number of foreign nations have in the past applied the "chosen instrument" monopoly theory to their air transport, as well as many of their other industries, sets no incontrovertible example for us to follow. One does not argue for the adoption of fascism simply bec use it is the chosen instrument politically of some foreign nations.

There have been definite reasons why, in some foreign countries, the "chosen instrument" theory was adopted. Mostly the reasons were economic, political and military. Fortunately those reasons in the same form do not exist in the United States and the adoption of the "chosen instrument" monopoly theory by the United States for those same reasons would work to the country's detriment rather than to its advantage.

The downfall of France was actually caused many years before the present war by the "chosen instrument" theory. One airline—Air France—and one integrated aircraft manufacturing industry operated under single non-competitive control. And when France needed airplanes they were not there.

The unification of any business into one company is the beginning of stultification and ultimately leads to complete Governmental control and probably to Governmental operation. Such a process inevitably brings costly and inefficient evils upon the business and, in the end, the public suffers. It is easily demonstrated that under Government control any reduction of salaries would be many times offset by the increased number of men employed, because politics has rules concerning relatives who must be taken care of. Rates would have to be raised, and the end of the experiment would be failure through increased operating costs upon the public.

There is one more phase of the "chosen instrument" monopoly which those who propose that we limit our transoceanic flying to one company have either overlooked or failed to mention—the aircraft manufacturing industry. There is a clear relationship and it ties in closely with our national security and welfare.

By now practically everyone is aware of the deplorable state of aircraft production at the outbreak of war. For years prior to the war the aircraft manufacturers had struggled along on orders for planes doled out to them in driblets by the Government and the airlines. We are confident that if the anticipated domestic airline expansion becomes a reality the aircraft manufacturers can look forward to producing a substantial number of transport planes. When those domestic airlines which plan to fly across oceans begin service, the additional planes which will be needed will do much to keep our aircraft manufacturing industry alive and prevent a repetition of the doldrums of the 1930's.

After the war, if there are three or four American flag airlines flying the Atlantic, the traveling public will not be dependent solely on one type of service or one single schedule of operation. On the supposition that a Boston business man wanted to fly to London, and the "chosen instrument's" American terminal was in New York and its European terminal was in Ireland, then additional travel would be forced on the passenger both in this country and in Europe. Complain as he might, he could do nothing about it.

No one is blind to the fact that many of the foreign airlines, nationalized or independent, plan to institute service to the United States. That is natural since our lines cannot expect landing rights in foreign countries unless such rights are available to their planes in the United States. These rights in the future will undoubtedly be reciprocal rather than by private agreement as they have been in the past. Our fear of foreign airline competition is unreasoned. The performance of those cartelized European airlines in the past certainly could not substantiate that fear.

And in the future, even presuming that many of the foreign airlines decide to use American equipment, which is the finest in the world, there is still the matter of operation. Even if they could bring their operating standards up to the high level perfected by airlines operating in this country, then the competition would result in still better service for the passenger. The stimulation of competition means constant improvement.

The more transoceanic service is allowed to develop unhampered by cartels or closed monopolies, the greater will be the benefits returned to the world. Through this rapid transportation there can be a quicker exchange of thought and understanding among the various nations. Such understanding is a vital necessity if we are to enjoy a truly lasting peace. Many American flag airlines reaching all countries of the world can do much to promote such a peace. END

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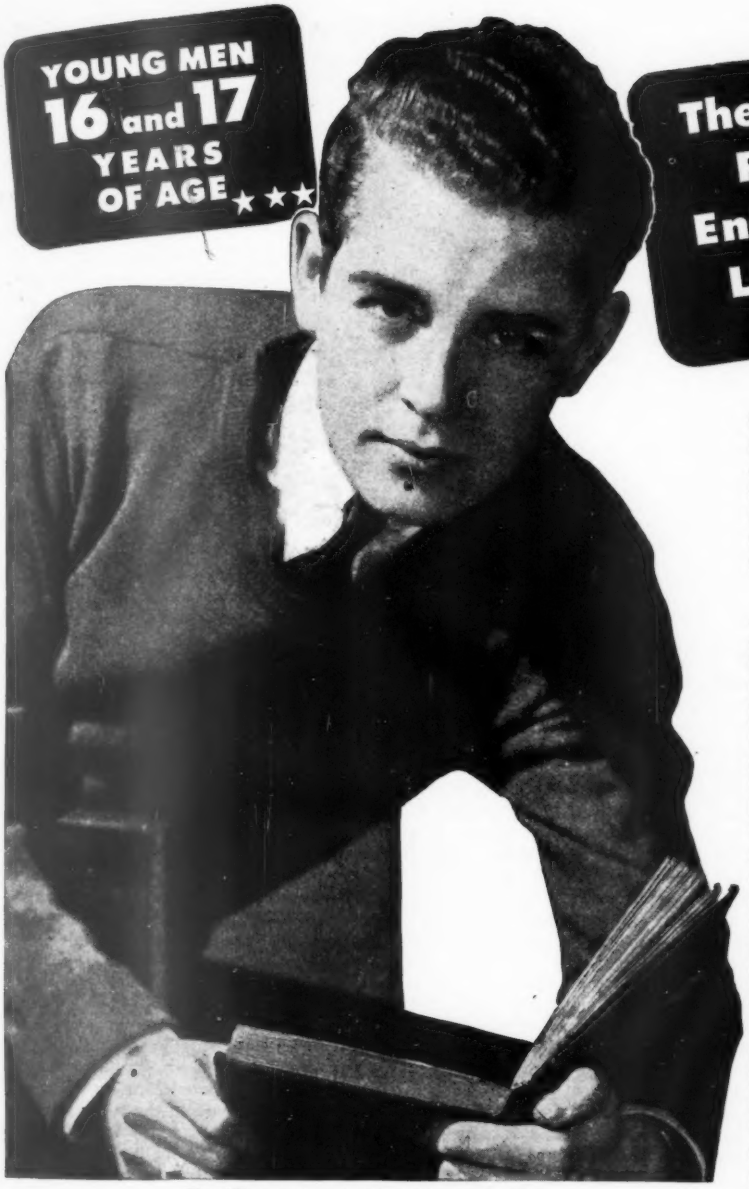

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William A. Patterson

(Continued from page 26)

(2) to preserve airline operations under the system of private enterprise.

Our studies have shown that, great as are the prospects ahead, the transocean field will present a relatively narrow market for some time to come. We have presented figures which indicate that, even in the choice No. 1 North Atlantic market, there will be fewer than 1,000 Class "A" passengers per day westbound and 543 per day eastbound during the peak month of September even four years from now, and that this traffic could be accommodated by 43 airplanes, each capable of carrying 100 passengers plus 5,000 pounds of mail and cargo. We have pointed out that a multiplicity of airlines in the transocean field might well produce dangerous, even disastrous, operating results.

We know that very keen competition is going to be offered to U. S.-flag operations by foreign competitors, government-owned or government-controlled. We believe that, in attempting to meet such competition and also to compete with one another, our present domestic airline operators might well face ruin unless heavily subsidized.

We are opposed to such subsidies as being inimical to the best interests of air transportation and to our No. 2 objective —that of preserving airline operations under private enterprise. Also, we do not favor any international subsidy war which is going to place an added taxload on the already greatly over-burdened public—a public which, we may be sure, is going to be more than a little interested in strict economies when this war is over.

Much is made of the words "chosen instrument" by those opposed to them. The word "monopoly" is brought out as a synonym—and one of seemingly bad odor.

Actually, there is nothing new about the chosen instrument philosophy. It merely describes the long-used practice of granting to one or more companies the responsibility and franchise to function as a public utility under Government regulation. Our telephone, power and traction services usually are operated by companies which are chosen instruments to provide public service.

Let it be understood that United Air Lines is strongly in favor of sensible competition. However, we do not favor it on a scale which could threaten the whole edifice of airline leadership under private enterprise which our industry has built so painstakingly over the past two decades. Even the staunchest advocates of the so-called "unlimited, free and open" transocean flying policy seem opposed to what they deem unwise and illogical competition on the domestic airways. This is evidenced by their testimony before the Civil Aeronautics Board, protesting against paralleling, additional services and entry into what they term their territory by other companies, although there probably will be 100 times as much traffic between such domestic points as there will be in transocean flying. To be consistent, it would seem that these operators should apply the same principle in regard to any unsound, uneconomical competition on the international routes.

As stated in our above-mentioned letter to the CAB: "The position of U. S.-flag air transport operation in transocean service on every ocean must be second to none, strengthened through the experience of domestic companies. But we urge that the factor of foreign nation competition, a factor not present during the growth of our domestic airlines, be realistically considered and that the air carrier know-how and resources of the United States be used under a transocean policy that will do credit to the principle of well-managed free enterprise."

We believe that, in one or more chosen instruments, this nation's airlines could pool all the experience, ingenuity and technological skills which have given us world supremacy. With such assets, we would be ready and able to meet the challenge of foreign airline monopolies.

A good deal of self-interest is going to have to be put aside by nations, by industry, by management, by labor and by individuals if we are going to build toward a lasting peace in the hectic days to come. Our airlines today can make a start in that direction by submerging their individual ambitions in favor of the common cause. By so doing they not only will be contributing their part to international good will but they will be insuring the most constructive use of the airplane as an instrument of genuine progress in the coming age of flight. END

Latin America's Air Future

(Continued from page 49)

A possible indication of post-war developments is the success that air cargo planes have already achieved in mountainous Central America. There, Transportes Aereos Centro-Americanos (TACA) and its affiliates have carried much air cargo.

TACA's success lies principally in the hauling of bulk freight in regions where surface transportation is difficult. More than 60 per cent of 1940 income was derived from air freight as compared with less than three per cent earned by U. S. domestic air carriers from express during the same year.

Should additional air cargo services be developed elsewhere in Latin America in the post-war period, considerable expansion of airports would be necessary

Post-war development has been suggested in studies of air cargo shipments of fresh fruits and vegetables. These studies are being carried on by several Government agencies and private groups.

(Continued on page 152)

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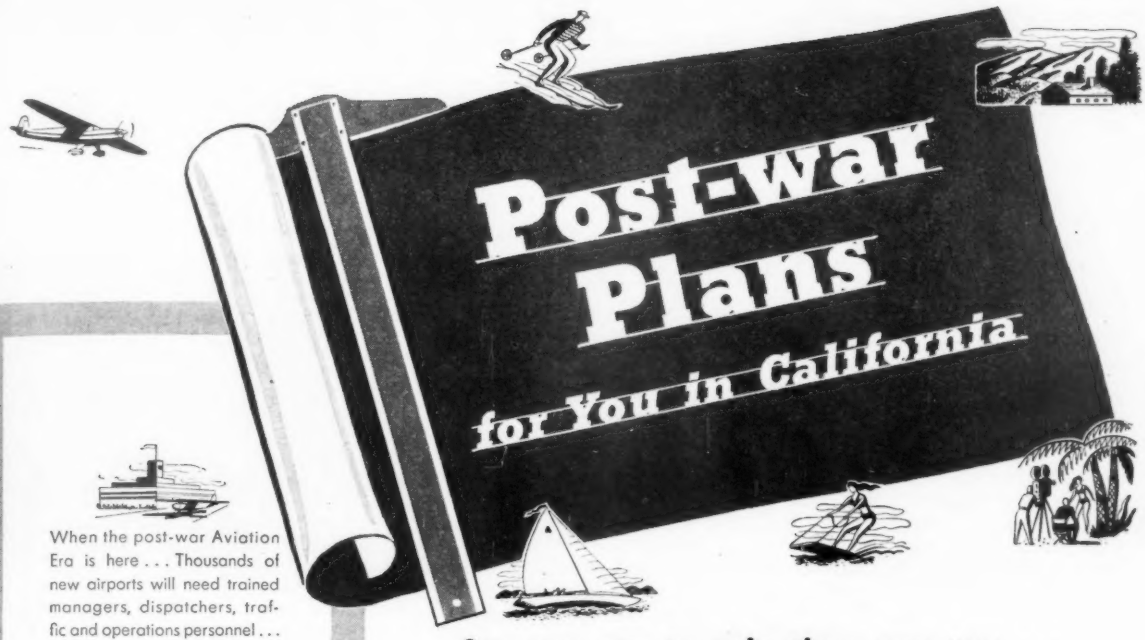

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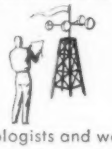

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(*Continued from page* 148)

The war has brought about the realization by the American peoples that the economic systems of the United States and most of the other American republics in large part are complementary. A total of $1,300,000 imports to the United States from Latin America in 1943 has emphasized that inter-American co-operation, based on the concept of mutual aid for mutual benefit, has a solid economic base.

There can be little doubt that the airplane, already a mighty force for inter-American unity, will become a still greater instrument of solidarity among the free republics of the western hemisphere. END

How We Must Use Air Power

(*Continued from page* 142)

lery with high angle fire or a curved trajectory, where the projectile goes up into the air and then down towards the target and therefore can be placed a short distance ahead of the advancing infantry without danger of hitting them. In the capture of Kwajalein and other islands, Army artillery was so placed on neighboring reefs that an accompanying fire could be given the infantry.

Thus, from Tarawa on, the attacks in the Pacific have consisted of both preparatory and accompanying fires. That part of the fire nearest to the infantry has been fired by Army artillery, while the flat trajectory Navy guns and the bombers have furnished that part of the fire further back. Our Navy also uses its dive bombers in direct attacks on enemy targets just in front of our advancing infantry in the same way that the Germans have used dive bombers since the beginning of the war.

In General Montgomery's victory at El Alamein he used both a tremendous concentration of artillery and the air force available to him for a preparatory and accompanying fire. Afterwards, up to and including the final surrender of the Germans in Tunisia, no such concentrations of fire were had.

When Cassino was bombed by a concentration of our heavy bombers it was virtually an isolated action. The bombing and an artillery preparatory fire and an infantry attack were not carefully coordinated to provide maximum mutual support at the right time, as was true at El Alamein. In addition, unlike El Alamein, there was no accompanying fire at Cassino and the German infantry was able to come up out of its holes, in which it had hidden to escape the bombing, and successfully resist such infantry attack as took place.

The claim that aviation can isolate the battlefield is excellent in theory, but is not borne out by what has happened in battle to date. Nor do the Germans and Russians, who have done a great deal more fighting in this war than anyone else, subscribe to the theory of battlefield isolation.

Great credit has been taken for the isolation of the German troops in North Africa. Undoubtedly, aviation played an important part in this isolation. However, had North Africa been part of Sicily, instead of being separated from it by the Mediterranean, the German forces, or a large part of them, would undoubtedly have successfully retreated to Sicily just as the German forces retreated from Sicily to Italy and then up the Italian Peninsula.

Little has been said about the fact that units of the American and British Navy controlling the waters between Tunis and Sicily played the decisive part in preventing the escape of the German troops from North Africa.

The battlefield of Cassino and the German line to its right and left were never isolated, though we heard much of their being cut off because of the bombing of the very few lines of railways and roads which led to it and above all of bombing the Brenner Pass.

The bombing of these lines of communication and the rear of the German Cassino line did not prevent the Germans from moving divisions to halt successfully the advance from the Anzio bridgehead and prevent its use in outflanking the German Cassino line.

Besides the German coast defense positions, there probably were only two infantry divisions and one armored division in the general neighborhood of our Normandy landing.

A great deal was said about isolating this battlefield by cutting all the bridges across the Loire and the Seine, the railways to its rear and the road junctions.

Yet, more than a month after the landing was made, we reported 16 German divisions on the American and British front. These troops have been fighting with enough intensity to prevent any advance on our left much beyond the line we had several days after landing.

Nothing could be more proof that the Normandy battlefield has not been isolated by our aviation.

Had the planes used in this attempted isolation been used on the German troops opposing us, in addition to the artillery fire of our guns on shore and of our warships, there is little doubt that these German troops would have been driven south and east and that we would have been today much further into Normandy than is now the case.

Far from isolating the battlefields, the Germans were given the time to bring their strength up, despite their loss of Cherbourg, to almost that of the British and American landing forces.

Time is of the greatest importance in an invasion. Landing forces must move inland so quickly that the defenders cannot pin them down to beachheads and perhaps one or two ports. Otherwise they cannot secure large enough bases in which to land everything necessary to begin a real invasion.

A landing is not an invasion. We landed on the Anzio bridgehead in Italy, but it was many weeks before that landing be-

(*Continued on page* 154)

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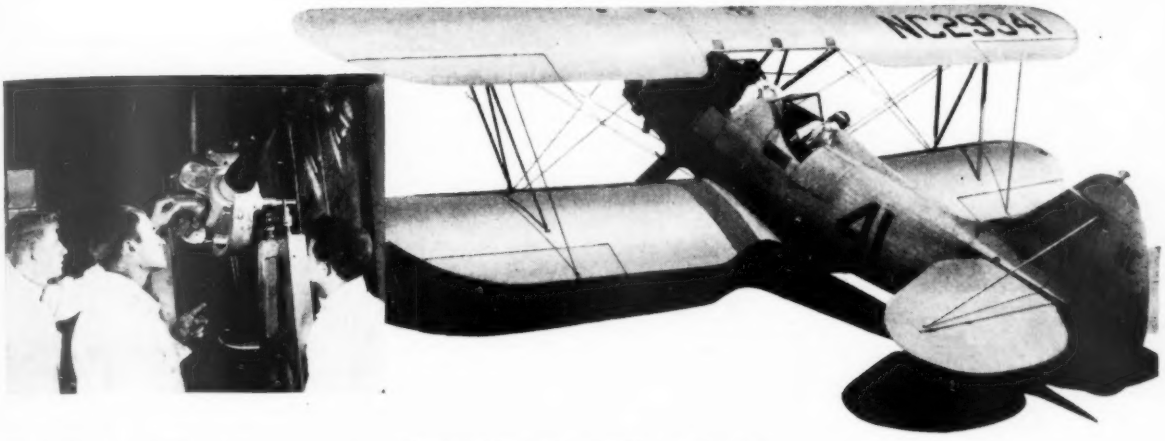

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came part of the Italian invasion. This happened only when the German retreat from the Cassino line allowed our troops in the bridgehead to advance.

As long as landings on hostile shores are considered as secondary operations to strategic long-range bombings, our invasions will proceed slowly.

Once in Italy, the establishment of a long-range bombing airfield at Foggia was given priority over reinforcing our ground forces which were consequently held up.

We were hardly ashore in Normandy before a large part of the air force was withdrawn to resume the long-range strategic bombing of Germany.

If real invasions are to gain decisive victory, it is more important that the troops on the ground go steadily forward than that new long-range bomber airfields be established to reach further into enemy territory.

Every event from the outbreak of war in September, 1939, has proven this.

The war furnishes a long record of bombing German submarine and surface vessel bases. This bombing has not stopped their use.

The same is now true of the robot plane bases. They have been repeatedly bombed, yet the robots are still operating over southern England. The capture by ground troops of these platforms would end the robot bombings, just as the capture of the submarine bases would end their attacks on shipping.

Further, relying primarily upon strategic long-range bombing instead of making the advance of the ground troops the primary objective, gives the enemy time to extricate himself from difficult positions such as that he was in at the time of Stalingrad, and thus enables him to prepare to meet new offensives such as the present one in Normandy.

From September, 1939, until the landing in Normandy, which was followed by the Russian attack in the east, the Germans always had the time to concentrate first on one enemy and then on another without ever having to look in two directions at once because of large scale attack upon them.

The relatively few German divisions employed in North Africa and then in Sicily and Italy are such a small number comparatively that none of these operations constituted a threat to the Germans.

The strategic bombing of Germany, even if as successful as claimed, could not make itself effective quickly enough to aid the Russian advance materially.

This is why the Russians persistently and forcibly insisted upon the establishment of a second front on the continent of Europe on a scale large enough to really divert German reserves and in a locality really dangerous to the German position in Europe which the Italian campaign was not.

Had there been enough ground troops available to reach the Rhine in 1939 and to seize Norway in 1940, then the Allied aviation would have had bases for their strategic bombers which would have permitted them to reach every part of Germany nearly four years before it was possible under the strategy which put the importance of ground troops in a subordinate position.

Similarly, the shuttle bombing which is now taking place could have begun months before it was possible because our position in western Europe would not have forced us to wait until the Russians had advanced to their present position.

It is the advance of the Russian ground troops which has made possible the strategic bombing of all Germany, not the strategic bombing of part of Germany which made the Russian advance possible.

The more the matter is studied, the more it is evident from the events of the war to date that effective use of aviation on land, as in Europe, depends upon the advance of the ground forces.

Therefore, the effective aid by aviation of such an advance should be a primary mission of all aviation and not just of tactical aviation and even then, as is our present custom, only in third place.

From nearly the beginning of the Pacific conflict, our aviation has shown itself superior to Japanese aviation under equal conditions.

Yet, despite the increase of our aviation, we have not made any appreciable gains in the two and three-quarter years since Pearl Harbor was attacked.

Why?

The answer is simply that the vast distances of the Pacific prevent land-based aviation from doing any such damage as is true of the British and American aviation over Germany. In the Pacific our aviation must be carried by aircraft carrier or ship in order to concentrate on enemy territory with sufficient force, whereas only a few score miles of the English Channel separate our British-based planes from enemy territory.

The fighting in the Pacific to date proves that carrier-based aviation alone cannot win a decisive victory. This is true, first, because the carriers are so weakly armored and gunned that they must fall prey to the planes of an enemy carrier supported by a more heavily armored and gunned surface vessel than the carrier. It is true, secondly, because carrier planes alone cannot destroy the new battleships such as those we are now sending to the Pacific. It takes both battleship gunfire and aviation fire to do this.

The only answer, then, is to assign the most heavily armored and gunned surface ship—the battleship—as the companion of the carrier. This makes a team which only a force of several carriers and several battleships can overcome. (As long ago as 1931 the author advocated in an article the need for experimentation with ships capable of bearing heavy guns and armor and carrying numerous planes.)

Thus, as on land in Europe, at sea in the Pacific aviation fire alone cannot do it, but must be concentrated with naval artillery fire upon enemy targets.

The recent statement of Secretary Forrestal that the objective is the destruction of the Japanese fleet, shows that the Napoleonic principle of the destruction of the enemy's armed forces is being followed in the Pacific.

We want to defeat both Germany and Japan decisively. We want to do it in the minimum amount of time.

The crux of the whole matter is simply this: that when the fire of aviation is added to the fire of ground troops (a) on

(*Continued on page 158*)

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(*Continued from page 154*)

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First, by enabling the ground forces to advance, destroying the enemy's ground forces and *capturing* all the Navy and submarine bases, robot-launching platforms, airfields, factories, oil supplies—everything else, in other words, to completely stop the enemy from making war on land, at sea and in the air.

Second, by enabling at sea (Pacific) the *capture* of the enemy's sea and air bases on the various islands, the possession of which enables them to operate against us, without which we cannot operate against them, but whose capture does permit us to operate against them.

From the Spanish Civil War in 1938, when both sides had fully developed their armed forces, to date, every campaign without fail has indicated the shortcomings of Douhet's theory and shown instead that air, used to the full extent of its wonderful possibilities, jointly with sea and ground forces, increases the speed with which decisive victory can be obtained when Napoleon's principle of destroying the enemy's armed forces in battle is followed. The concentration of all possible fire instead of its dispersal in the answer to this. END

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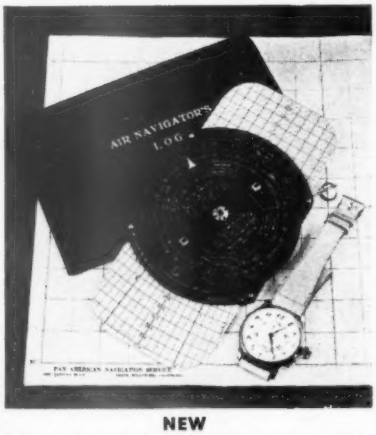

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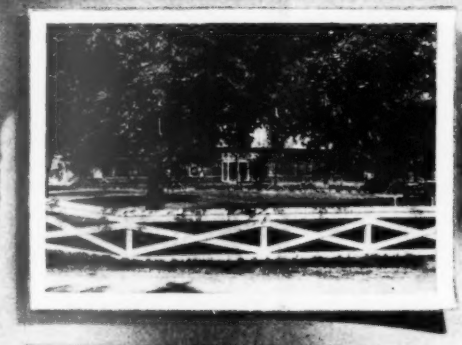

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